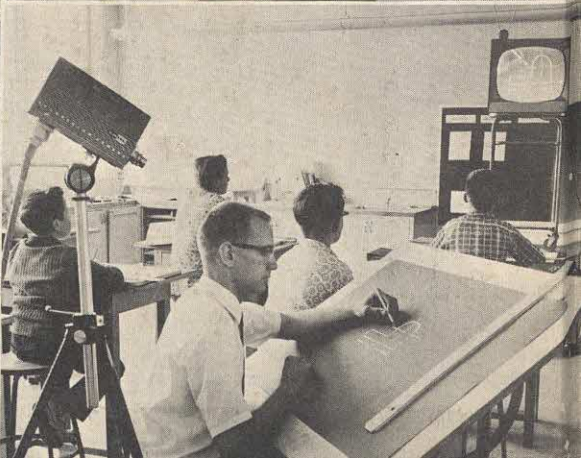
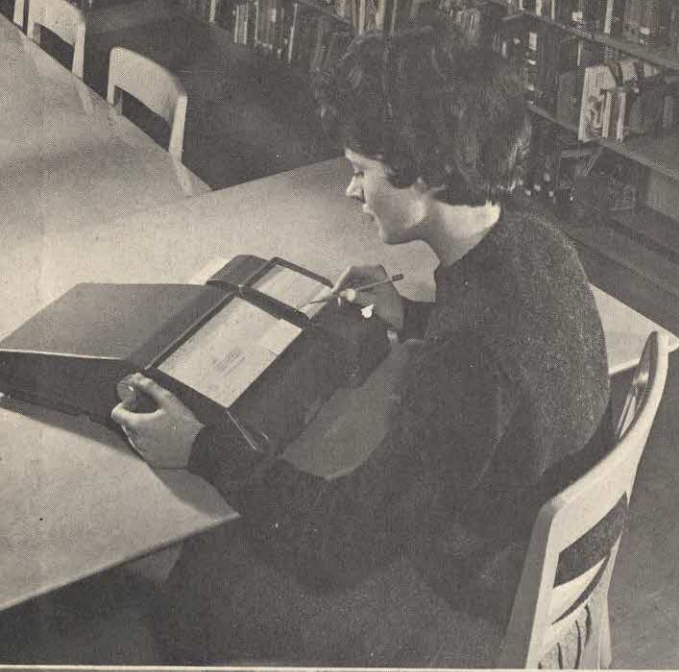
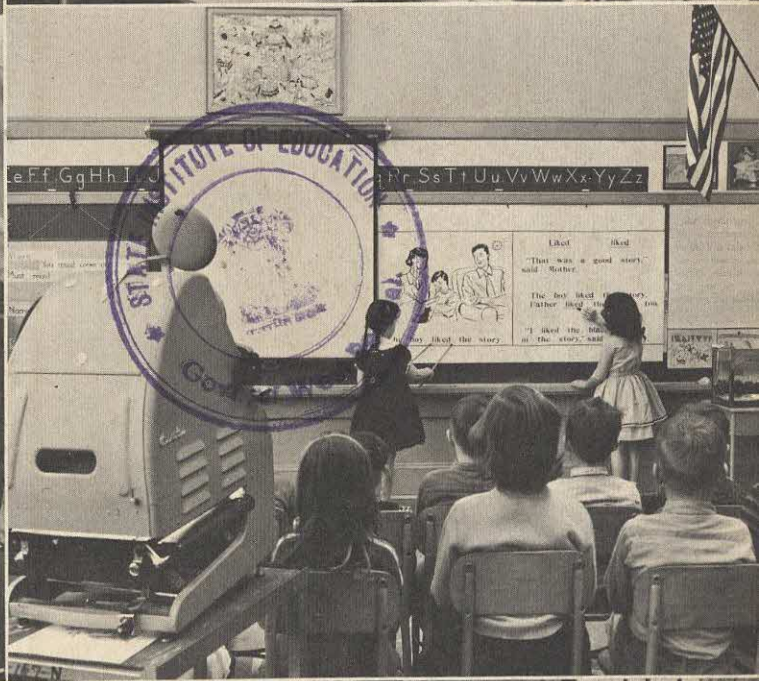


FUNDAMENTALS OF TEACHING WITH
AUDIOVISUAL TECHNOLOGY

CARLTON W. H. ERICKSON





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TO MY WIFE ERNESTINE

PREFACE

This book is mainly directed toward the undergraduate student preparing for a career of teaching. It is a book about instructional technology as applied professionally to the achievement of educational objectives. It is a book of fundamentals, a short book, designed to facilitate the development of insight and performance. In this book we say to the student, "Develop insight into end-and-means relationships, develop the basic abilities to make instructional designs, identify a breadth of teaching purposes, plan and implement appropriate problem-solving activities, and relate creatively the common educational media with maximum impact to those learning activities." However, these same basic insights and abilities are also required today by teachers everywhere in varying degrees. A staggeringly large job of in-service education confronts every school principal and supervisor in the area of instructional technology, and this tersely written text with its case studies and sequences of questions may serve school-staff study groups well in their organized efforts to improve their use of technological materials. Also valuable for group and self-study activities would be the step-by-step procedures for preparing a wide range of materials from tape to transparencies, the suggested teaching practices characteristic of each medium, and the instructions for learning how to operate the instruments.

It is not easy for us as teachers to get our students—wherever they are, in informal or formal groups—to use what they already know, or what they have already experienced, in developing new insights and abilities. College juniors and seniors in teacher-education programs seem to remember very little about how their teachers proceeded in class during their fourteen years of formal school experience. Yet, one often hears the painful reminder that "we teach the way we were taught, not the way we were taught to teach." Somehow we as teachers in professional courses should tap the working knowledge of the classroom possessed by each of our students in an effort to move them away from patterns to which they blindly adhere. We need to find ways to get our prospective teachers to be creative in their hypothetical plans and to make plans for actual implementation during their practice-teaching experience. We need to stress the process of innovation as teaching plans are constructed and carried out and we must insist that students innovate in the light of valid principles and objectives. An optimum combination of general principles, specific operational teaching techniques, and decisions about instructional fundamentals will facilitate this kind of action by our students.

Today we not only hand the prospective teacher a set of experiences in educational psychology, a concentration in subject matter, and a textbook to teach, but we also presently hand him scrambled books, a teach-

ing machine, a television receiver, a team-teaching assignment for a group of a hundred pupils, and an impressive array of additional educational media, all fruits of technology. Many of these media may be classed as *old tools*, others as distinctly *new*. Many of the old tools, which we have had for decades, need to be used in new ways, together with, or as integral parts of, new media.

It was not intended that this book be written for a particular subject-matter field or any one grade level. The intention is to stimulate all teachers to apply fundamentals to their own unique teaching tasks; hence this is not a book of recipes. It is believed that this book will serve as a basic reference for the instructor who desires to organize meaningful activities for the mastery of basic information, to create valid teaching designs, to prepare unique teaching materials, and to learn operational skills. This book will facilitate the kind of thinking by prospective teachers that, through insight and actual commitment to performance, may relate audiovisual technology meaningfully and creatively to the fundamentals of good teaching.

The exercises at the end of each chapter suggest the way toward the fulfillment of the basic objectives that the writer as a teacher has sought and will seek to develop in his own students. Such exercises are therefore intended to serve as a study and activity guide that will be useful in a variety of courses when used with this book as a basic text. Such factors as the number of class hours students have to devote to discussions and laboratory work, the number of required hours of homework, the number of semester hours of credit given for a particular course, the nature of an instructor's objectives, the level of achievement sought, and the time an instructor has at his disposal for checking and/or grading written exercises submitted by students will have a bearing on the nature and degree of use made of the study-guide problems. Many of the problems may be used as the basis for discussion; others, however, demand a wide range of professional activity. In this connection instructors are urged to involve their students seriously in the ordered sequence of responses included as a part of each case study presented in Chapter 4. It should be recognized that these lists of questions constitute an effort to program the responses of the reader without asking him to write out the insights he has developed in the process. It was to facilitate this process that the case studies were stated in a condensed and easily accessible form.

The writer is grateful to his students and staff, to teachers, to authors and publishers, to schools and school systems, and to business organizations for their willingness to make contributions to the content of this book, and due credit is given in the footnotes.

The author is also deeply indebted to Ford L. Lemler, Director of the University of Michigan Audio-Visual Education Center, for the many helpful suggestions made in connection with his critical reading of the manuscript.

C.W.H.E.

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1

THE NEED FOR AUDIOVISUAL TECHNOLOGY IN TEACHING

In recent years technology has swept through society from the research laboratories into manufacturing, communications, the space age, and, finally now, into education. Educators everywhere, some aided by foundation grants and by financial support growing out of national legislation, are exhibiting an intense interest in teaching methods employing such new media as television, taped instruction, and teaching machines. Even the older media such as filmstrips, slides, and motion pictures are now acquiring a new technological aura as they appear not only in conventional classrooms, but also in large-group team-teaching situations, in combination with television programing, in instructional packages, and in self-instruction processes.

The classroom use of the earliest technological materials was called *visual education*. Advancing technology changed this in a few years to *audiovisual education*. The most fortunate teachers, then and now, had and have at their fingertips the resources of special school-building and school-system technological service centers known by various names. Visual education department, audiovisual center, instructional materials center, curriculum materials center, instructional technology center, audiovisual communications center, communications media services, and learning resources center are just a few of the names various school systems have applied to the organizations that they have established to help teachers make use of modern-day methods involving the new technology.

It is nevertheless true that the development of technological services for teachers from kindergarten to the university has been proceeding very slowly since 1904 when St. Louis inaugurated the nation's first city-wide visual education service program. This development has now quickened considerably with the realization that antiquated methods can never achieve today's educational goals.

However, school leaders cannot ignore sixty years of experience with technological materials, first visual, and later audiovisual only to magically assimilate the newer materials and processes in a sudden rush of desire, however laudable, to put them to work. It is entirely true that the successful use of *television* and *automatic machines* often depends upon the integrated use of many kinds of the older teaching materials such as motion pictures, slides, maps, charts and diagrams, magnetic and flannel boards, apparatus as for distillation and electrolysis of water, and models such as a lifesize torso, to mention just a few. Undoubtedly, there is no better way to prepare for the technological methods of the future than to build upon a backlog of staff experience in using some of the commonly available technological media and methods that have been important for years, and still are important, in making teaching effective. Accelerated development of instructional programs demands a qualified leadership staff, adequate financial support, and unusual cooperation and skill on

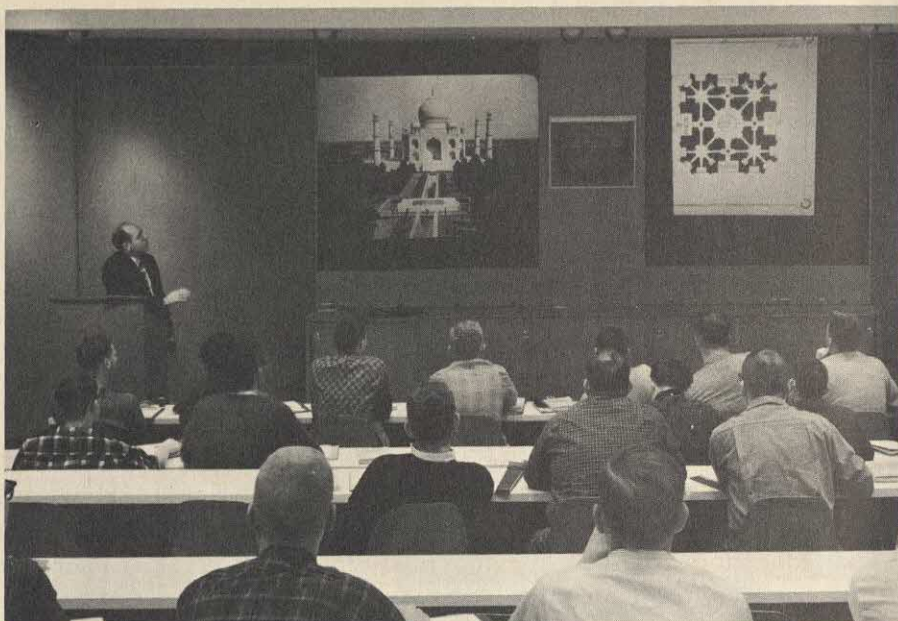


Figure 1-1. Classrooms in new and remodeled schools are acquiring a technological appearance. Striking changes in shape, size, and instruments are apparent. Television receivers, overhead projectors, and multi-media projection by means of automatic controls through rear-screen techniques are recent developments. Few schools possess such extensive installations as in this college classroom. Figure 5-29 shows a similar installation with an overhead projector being used simultaneously. (Courtesy School of Architecture, Rensselaer Polytechnic Institute, Troy, N.Y.)

Figure 1-2. In this biology class of 100 students at the high school in Wayland, Mass., the teacher is presenting a lecture in the modern way. Audiovisual technology is contributing to this teacher's impact. What learning conditions can be identified in this situation, actual or implied, that contribute to effective communication? (Photograph by George Zimbel, Peekskill, N.Y.)





Figure 1-3. Audiovisual technology has opened new and challenging roles for teachers with unusual talents. This studio teacher has a wide array of media at his command, and more time to plan and prepare his presentations than is generally available to classroom teachers. His influence may spread through medium of television to many schools and large target audiences. (Courtesy South Carolina ETV Network, Columbia, S.C.)

Figure 1-4. The long-established medium of the sound motion picture is now often used in a new way as a part of multi-group activity by means of headphones and an aggregate box as shown in this picture. (Courtesy La Mesa Spring Valley School District, La Mesa, Calif.)





Figure 1-5. Objects and models were the technological materials of the nation's first city-wide visual education service for teachers. This development took place in St. Louis as an outgrowth of the St. Louis Exposition of 1903. This program has kept pace with the times, today including radio and television and other comprehensive media services. (Courtesy Public Schools, St. Louis, Mo.)

the part of the staff of teachers. It is not simple to adopt technology, for these materials are not bought quickly and "just shown" to a group of pupils any more than a textbook is "just read." Good teachers know this. It is when teachers generally "teach the book" that they also "teach the film."

This book is devoted to teaching the prospective teacher, in the midst of his program of preparation, how to use technological media effectively. And so we may set forth the main topic of this chapter in a question, *What is the need for technology in teaching?* The answer will be found in an analysis of the roles that technological materials play in helping teachers find greater success in their complex art.

Before we answer the main question in this chapter, it will be helpful for the young teacher to eliminate some of the confusion that arises about terminology. This is doubly important because the terms are not truly satisfactory, neither the old nor the new.

Eliminating Confusion About Terminology

Years ago we changed *visual* to *audio-visual* education and then we removed the hyphen. We changed *aids* to *materials*, and quickly discarded

multi-sensory materials. We did not like *teaching tools* either. *Instructional materials* and *curriculum materials* seemed to be too inclusive, and besides in them we tended to lose sight of the newer technological developments. Hence we now like to refer to *technological materials*, *instructional technology*, *audiovisual communications*, *learning resources*, and also to *instructional or educational media*, or *new educational media*. It also seems proper technologically to adopt the term *instruments* as an inclusive expression for equipment and machines such as projectors, record players, tape recorders, and the hardware of the so-called teaching machines. Actually, terminology has not been standardized, and it remains for us to employ a range of these terms as we communicate with individuals and groups in different localities and environments. We use several of the terms just mentioned in this book, often synonymously, but we abhor the use of the expression *aids*. *Aids* is an obsolescent term long associated with the idea of making the learning "pill" more palatable. We now know that other terminology is needed to imply the new, significant, and expanded roles that must now be played in the teaching-learning processes. The meanings of the terms we do use need to be clarified, and we explain first a widely used and commonly accepted expression.

Audiovisual Materials. In this discussion, the expression *audiovisual materials* will refer to those teaching materials, some real, some graphic, not solely dependent upon words as a predominant source of meaning for the observer. Such materials include field and classroom study of real

Figure 1-6. The field trip provides students with useful experiences in the study of real things. Parents should take their youngsters on many field trips, informally handled, of course. Field trips taken during school hours should be considered as formal instructional activities. Here students visit the Stephen Fitch House, one of forty exhibit buildings at Old Sturbridge Village, Sturbridge, Mass. (Courtesy Old Sturbridge Village.)



things; demonstrations and dramatizations; objects, models, and mockups; displays and exhibits; television programs and motion pictures; lantern slides (standard and miniature, both photographic and handmade); transparencies for the overhead projector; sound and silent filmstrips; projected study prints and other illustrations (opaque projections); objects for a microprojector (both slides as well as animate or inanimate specimens); photographic enlargements; text and pamphlet illustrations; magnetic tape and disk recordings; and graphic portrayals such as maps, globes, graphs, charts, posters, diagrams, and cartoons. Whenever it is used, the expression *audiovisual materials* will refer to all or combinations of the items listed above.

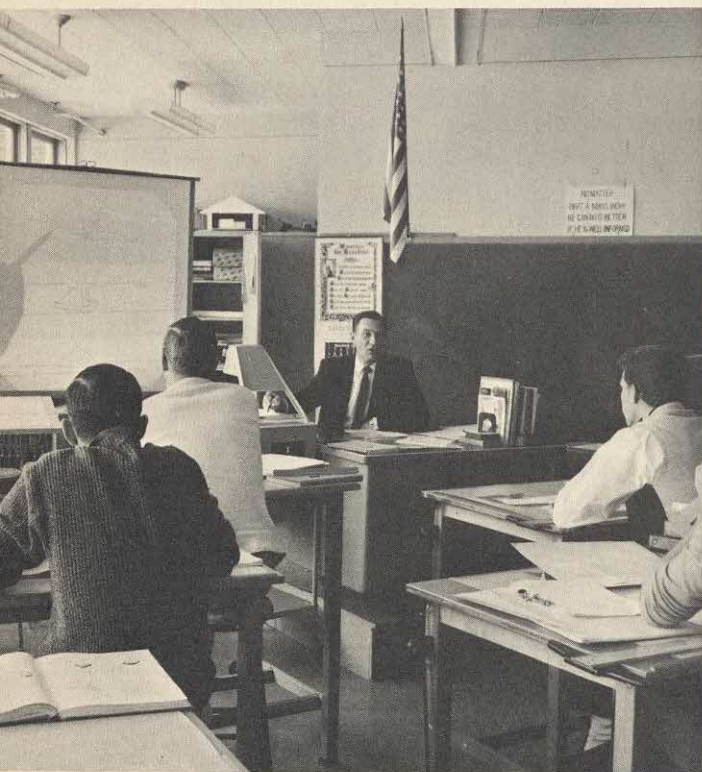


Figure 1-7. In this mechanical drawing class, the teacher is using transparencies to make explanation clearer. Note the physical arrangements: projection screen in the corner and the teacher seated to afford an unobstructed view of the projected material. (Courtesy Visual Products Group, 3 M Company, St. Paul, Minn.)

Just as we use both language and pictorial media to communicate with the reader in this book, we caution him to strive for an understanding of the interrelationship that must exist between audiovisual media as just specified and the whole range of language methods. On the one hand, we use audiovisual materials to make the meaning of words clear, and, on the other hand, we use words (verbal methods, using all printed media) to make pupil experiences based on audiovisual media presentations clear, meaningful, and useful. However, though we in no sense depreciate



Figure 1-8. The transparency that this music teacher is using provides the means for pinpointing attention to specific stimuli calling for guided responses. Teachers who stand up during such presentations need to arrange students so that they may have an unobstructed view of the screen. (Courtesy Visual Products Group, 3 M Company, St. Paul, Minn.)

the power of verbal methods in teaching, we must, as one of the salient features in this book, emphasize the essential character of audiovisual materials, namely, that they make possible a broader range of sensory stimuli. Hence, they provide a more direct form of experience to facilitate hearing, seeing, doing, and trying. But we shall always imply in the following pages that language and all verbal methods are also effectively and interrelatedly employed.

Instructional Materials. The expression *instructional materials* is a broader term than *audiovisual materials*. It includes in addition to audiovisual materials such printed materials as textbooks, pamphlets, documentary leaflets and reports, sheets of special directions for problem solving, and programed learning sequences for use with or without machines. When using the term instructional materials, we must be careful to include in its meaning *all* instructional materials.

A question should be posed here: What is the relationship of *audiovisual materials* to *programed learning sequences*, or to *teaching machines*, to use the broader term? Specifically, audiovisual materials may serve as rich resources of illustration and sensory experience for the verbal frames of a programed sequence. Sometimes a teaching machine with hardware is designed to communicate through a combination of media such as a magnetic tape for language and a sound-effect sequence presentation as in music, even adding a still picture frame for reference by the pupil. Confusion arises, however, when it is claimed that a purely verbal programed sequence should be classed with audiovisual media. Actually,

by definition, it should not be. The same relationship exists between audiovisual materials and programmed instruction as between audiovisual materials and the total process of instruction. It is true, however, that the trend is to assign all electro-mechanical instruments, whether they are for teaching machines or not, to the learning resources center staff for servicing and distribution. But in this book it is hardly necessary to be



Figure 1-9. In this teaching machine the programmed learning sequence is presented by means of a standard 35 mm filmstrip containing pictorial and/or diagrammatic reference content. Here visual components may become an integral and crucial part of the self-instruction process. In this "Redi Tutor" teaching machine, the student is shown writing a response called for in the content of the item being presented. Following the writing of each response the student pushes a button to bring the answer frame into view, and after comparison, the next frame containing the next item and so on to the end of the sequence. Is the process shown an example of individualized instruction? An example of the self-instruction process? (Courtesy Du-Kane Corporation, St. Charles, Ill.)

frustrated about the assignment of responsibility for classification and/or control of teaching machines. Instead, we need to recognize fully that it is the teacher who will take action to achieve valid teaching objectives by a combination of duties, involving selection of *all* materials and arranging the psychomechanical conditions for their use.

Technology. The title of this book incorporates the term *technology*, and it should be stressed that technology is an inclusive term that is as broad as the total scientific, economic, and industrial development of our country and of the entire world. When we consider a specific segment of the total technological development, for example, the technology that is involved with instruction, we must use a new term, *instructional technology*. The Commission on Definition and Terminology of the Department of Audiovisual Instruction of the NEA has defined *technology* as follows:

(1) A systematic body of facts and principles related to a comprehensive, practical, and useful end. The term is not limited to industry or to engineering. The principles of effective teaching (pedagogy), for example, comprise a tech-

nology. (2) The actual processes of manufacture in a given industry or plant (English).¹

Instructional Technology. In view of the definition just quoted, this is an inclusive term that refers to both the materials and the instruments, and even to the instructional system to be used with them. Every teacher knows that a motion picture projector is of value only as the projected films change the behavior of viewers in desirable ways, and what the teacher says and does in terms of systematic application of principles is also a part of a technological whole. Similarly, it is the tape-recorded content that makes the magnetic tape recorder-player valuable in the classroom together with the special utilization plan for listening and response. Thus even in the glamorous, electronic teaching machines it is the programmed sequence for obtaining student responses, with or without pictorial and audio stimuli, that gives the machine its instructional potential.

We are therefore using the expression *instructional technology* because it does have mechanical and electronic connotations; however, we are also using this term because it is a broad one that includes the entire range of both old and new teaching materials that we now call *audiovisual materials*. While there is, strictly speaking, a technology of textbook manufacture, we are using *instructional technology* as a synonym for *audiovisual technology*.

Media. Another set of expressions involves the term *media*. Let us turn to two related published definitions of two of these expressions. *Educational media* is one, and *new educational media* is the other. The task force appointed by the Department of Audiovisual Instruction of the NEA to study the function of media in the public schools defines *educational media* as follows:

Educational media are defined here as those things which are manipulated, seen, heard, read or talked about, plus the instruments which facilitate such activity. Educational media are both tools for teaching and avenues for learning . . .²

The second definition pertains to *new educational media*. This expression was also defined by the Commission on Definitions and Terminology as follows:

Term used in various titles of the National Defense Education Act of 1958 to describe pertinent materials and technological devices: TV, teaching machines,

¹ Donald P. Ely (ed.) (Prepared by the Commission), "Alphabetical Listing of Terminology," *Audiovisual Communications Review*, 11, No. 1, Supp. 6 (January 1963), p. 78.

² Barry Morris (ed.), "The Function of Media in the Public Schools," (A Task Force Position Paper), *Audiovisual Instruction*, 8, No. 1 (January 1963), p. 11.



Figure 1-10. The materials in this instructional kit, titled *Man and His Environment*, provide teachers with the opportunity to use the multi-media approach in teaching a unit of work. Also included in the multi-media approach would be the library and textbooks. Is the process of guiding pupil responses and providing for pupil productivity a vital aspect of the multi-media approach? (Courtesy International Communications Foundation, Monterey Park, Calif.)

programed learning material, electronic learning laboratories; it also includes many well-established audiovisual media such as motion pictures, filmstrips, slides, and recorders.³

We shall make frequent use of media in a broad sense and shall also use the word *medium* in the narrow sense of denoting a kind of material, or a group of similar materials, as the television, motion picture, or still picture medium. We shall also refer to groups of media as audiovisual or technological media. Two other expressions using media are worth noting by prospective teachers; they are *multi-media approach* and *cross media approach*. The Commission previously quoted considers these terms to

³ Donald P. Ely (ed.), *op. cit.*, p. 61.

have the same meaning, and it has defined them clearly and concisely as follows:

Methodology based on the principle that a variety of audiovisual media and experiences correlated with other instructional materials overlap and reinforce the value of each other. Some of the material may be used to motivate interest; others, to communicate basic facts; still others to clear up misconceptions and deepen understanding.⁴

The multi-media, or cross media, approach is particularly evident in Case Study Number 6 in Chapter 4, and it is implicit in Chapter 5, where some of the classroom operational concerns are discussed in a situation where audiovisual media are used in combination. Instructional kits or packages are almost certain to combine textbook, pictorial, and audio media for maximum learning impact, and, in today's classroom, teachers increasingly make use of demonstrations, models, displays and exhibits, several frames of one filmstrip, and a motion picture or "film clip" in addition to textbook references and student project work. The combinations are of course limitless, depending on many factors, some personal, some physical in terms of school facilities and services.

Now we must go back to the major question of this chapter, namely, *How does audiovisual technology help the teacher?* We now know that audiovisual technology refers to a particular category of instructional materials. It is these materials that we say may play six basic roles in helping teachers teach. This help, however, is not automatic. This help accrues to those teachers who are competent, are possessed of mental vigor, and have at their disposal reasonably effective local resources and services.

Roles Played by Audiovisual Technology

In the following pages we assert that audiovisual materials, which comprise this aspect of technology, may perform some superhuman tasks for the teacher. We must caution the reader to note, however, that not each of the materials plays each of the roles. On the other hand, some of the materials or media may play more than one role at the same time or at different times, as the examples will show.

The discussion that follows is presented as a simplified overview that points out the vital need for audiovisual media in the teaching-learning situation. Each successive chapter then develops in detail the nature of the teacher decisions required to unleash their potential impact.

⁴ Donald P. Ely (ed.), *op. cit.*, p. 44.

ROLE NUMBER ONE

We assert first that every teacher's job would be easier if pupils came to our classes possessed with the optimum amount of real experience that would facilitate learning. You may ask what experience? Shall we list some quickly? Would it make a difference in teaching methods? Would accomplishment be greater in our classes if pupils had had experiences in orbit, experiences in artistic creativity, experiences in visiting far-off lands, experiences in sailing the great clipper ships as well as the great leviathans of the seas today, experiences of being in historic places and being near to great personalities of history? But we hasten to ask, how much real experience is actually necessary before pupils can comprehend what they read and what is presented and verbally explained to them? How much experience with real things is needed before pupils can proceed to profit from abstractions? Reading a book and memorizing a list of conditions, or a list of causes, may not be sufficiently rich in meaning. We must not defy the demand for actual and realistic, although vicarious, experiences, because, if we do, our pupils will not possess a wealth of insight that will serve as a basis for building new relationships from new verbal materials.

Therefore we state the first and basic role as follows: *Audiovisual technology provides the teacher with the means for extending the horizon of experience.* By this role we seek to provide the counterpart of a first-hand experience. A student may sit in his Drivotrainer System car and, under realistic stimuli from film sources, practice responding to highway conditions and other drivers with amazingly realistic effects. Other simulators for other tasks may be developed. A teacher may "take" his class by means of an appropriate motion picture film to a remote jungle, to a glacier in Alaska, to "meet" people and "observe" places and things, to perhaps see new environments for the first time. Some audiovisual materials may thus serve as a "magic carpet" for providing needed experiences, vicarious of course, but perhaps extremely close in observational value to reality. Particularly valuable for this role would be motion pictures, television, and carefully prepared colored slide sequences.

Such "real" experiences may be planned and utilized in many teaching situations—in the middle of a lecture, as a means of introducing a new teaching unit, and as a means of seeking "first-hand" information for solving a problem. Such "real" experiences may actually last only a half hour or a few minutes. Thus through film one may be seated in the United States Senate on January 21, 1861 and listen as Jefferson Davis delivers his awesome speech of secession. Should we not also point out that

millions before their television sets shook with emotional tension as astronaut John Glenn was shot into orbit. These are intensely realistic experiences, and who can doubt that experiences frequently alter the course of our lives. Technology will serve teachers by providing these and other experiences immediately, and it may find ways to serve teachers



Figure 1-11. Audiovisual technology makes possible vital and realistic experiences like this in the classroom. In view of the relationship of cars to our economy, what contribution to the lives of present and future generations of people could wide experience with the Aetna Drivotrainer System make? Is this system not another example of the multimedia approach in teaching? Is it an example of a teaching system? What components of the system can you identify? Highway conditions are presented through motion picture films, and as students react to the stimuli their actions are recorded. The evaluation component of the Aetna Drivotrainer System is known as the projection and recording unit. It supplies the instructor with immediate knowledge of student successes and failures. (Courtesy Aetna Life Insurance Company, Hartford, Conn.)

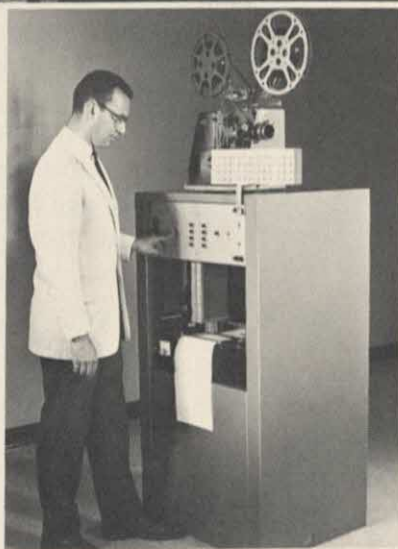




Figure 1-12. Some films may provide rich opportunities for "being there," a convincing feeling of reality. Teachers need to learn how, when, and why to use such experiences. Paying a 20-minute visit to a Malayan jungle may engender a feeling of acquaintanceship with the people shown in these pictures. Why might this be important in a given course or subject? (*Courtesy United World Films, Inc., New York, N.Y.*)

in this way far better in the future. Materials selected for this job must certainly possess unusual dimensions of reality. However, a word of caution is in order. Since perception is compounded not only from the physical characteristics of the real things observed, but also from the characteristics of our own frameworks of reference, teachers need to be aware that not all pupils will react to the same things in the same way. It is possible that sensitively conceived preparatory activities will be required if experiences via film or television are to have their needed impact.

ROLE NUMBER TWO

The second role may function simultaneously with the first, for in any real experience we tend to learn from our responses, and we remember a great deal of information. But this role is unique and one that teachers must not lose sight of if they are to use audiovisual technology effectively.

The second role is stated as follows: *Audiovisual technology helps the teacher provide meaningful sources of information.* Teachers everywhere in this complex age need to have at their fingertips the vast reservoir of graphic and pictorial material as well as the vast reservoir of primary visual sources, the term museum specialists employ to refer to real things, as additional sources of information. This is in no way a statement that textbooks and documentary materials are of less value today because of technological developments. The contrary is true. The task confronting education is now greater, and we not only have to teach more subject matter, but we have also now broadened the scope of our goals. Pupils need to be prepared for experiences, need to get, or be given, directions for performance procedures, facts about situations, and vivid descriptions of the application of principles. Hence we turn to additional sources, to new media, to television, to the film, to diagrams, charts, globes and maps, to slides and transparencies, to models and to real things, to enhance clarity of communication and speed of comprehension.

Audiovisual technology is thus able to provide the teacher with easily comprehended information from re-enactments of historic events, from the photographic enlargement of real things too minute to be seen, from the observation of normally unseen motion of objects, from the observable action of substances inside a space capsule, from views of effects on a driver's body when his car hits a bridge abutment, from animated diagrams of what happens to valves, pistons, and fuels inside a gasoline engine cylinder, and from the pictorial portrayal of changes in mass as the speed of a body increases, to mention just a few examples.

Technology in this second role may also work to help the teacher by carrying a larger than presently thought of portion of the information-teaching burden. A variety of media, both verbal and pictorial in nature, both abstract and real, coupled with individualized self-instruction processes, may be systematically employed in reorganized school groups to save precious hours and weeks for teachers in their day-to-day presentational tasks. Again, however, we stress that emphasis on memory of facts, apart from useful and lifelike orientation, may in truth be wasteful of time, technology, and personal energy. We need therefore to seek information in the light of pupil needs and valid problem-solving activities.

Technology in this role obviously may free the teacher from the repetitive and burdensome tasks of giving information for more creative work with students. In a school, where a combination of media such as programed text or machine, television, and motion pictures is used to present needed facts and principles, teachers need to make sure that students use the resources in libraries, laboratories, and in their community environments as the basis for engaging in the challenging work of

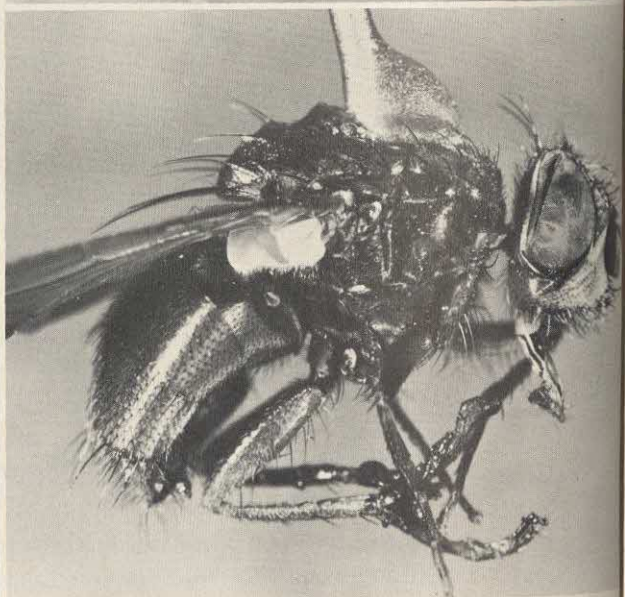
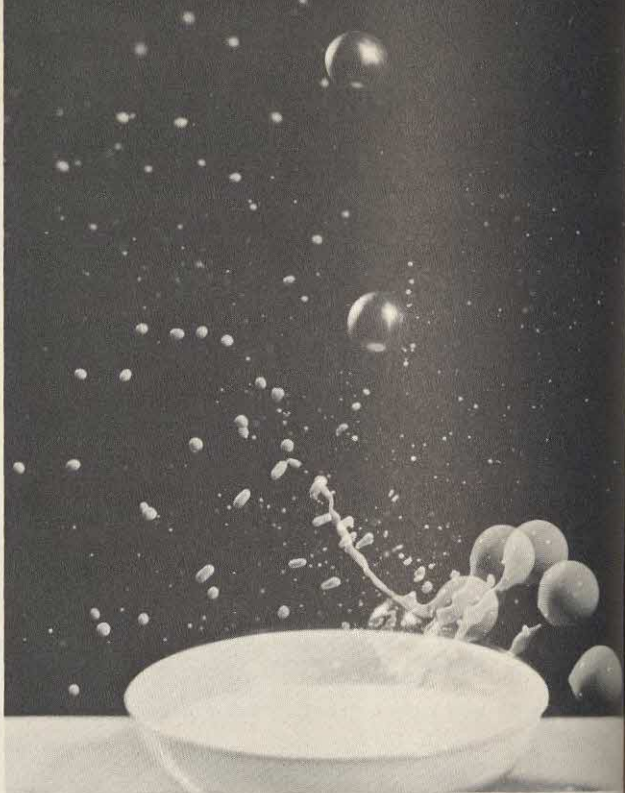


Figure 1-13. The continuity and content in the events, processes, and conditions portrayed in motion picture films provide rich sources of information. These pictures show, starting at the top, by optical means, changes in the mass of bodies due to speed, the normally unobservable action of a steel ball falling into a bowl of milk, the possible effects of forces acting on a human body in a car collision at impact by using a dummy, and a striking close-up view of a housefly grounded because of an impaired gyroscope that usually vibrates at 10,000 times a second. All of these scenes are from the motion picture, *Mystery of Time*. (Courtesy Moody Institute of Science, Los Angeles, Calif.)



Figure 1-14. In these two pictures high school girls are carrying on some of the steps in a weaving process on a 150-year-old loom, and elementary school pupils are studying the habits of a guinea pig. Real things such as these may become rich sources of information. What guidance do teachers need to give in situations like these? What objectives can the activities shown help to accomplish? (Courtesy Old Sturbridge Village, Sturbridge, Mass., top picture. Bottom picture, photographed by David H. Curl, The University of Connecticut, Storrs, Conn.)



Figure 1-15. Programed learning sequences may, in tutorial fashion, carry for teachers an increasingly large part of the burden of presenting information and developing concepts and insights. Audiovisual components of such processes will probably make increasingly large contributions. This Mast Development Company teaching machine presents the program through a film-strip cartridge. See also Chapters 2 and 5. (Courtesy Keystone View Company, Meadville, Pa.)

solving problems. This inevitably calls for teacher guidance. Audiovisual technology may well prove to be the means for providing extra hours for such vital face-to-face activity. We as teachers must always remember that when information is not put to functional use, it is easily forgotten.

ROLE NUMBER THREE

This role is the most well known and most widely used—the role most easily accepted by teachers at all levels of instruction. Actually, it is not ignoble to want to create interest in pupils, even if *interest* is rather narrowly conceived in the light of one's own subject-matter specialty. It is the driving desire to stimulate interest, to get pupils to want to work, to accept our presentations, coupled with the interest-compelling power of such audiovisual media as the film, that leads teachers to avail themselves all too uncritically of the help provided by this role. Role Number Three is stated as follows: *Audiovisual technology provides the teacher with interest-compelling springboards into a wide variety of learning activities.*

We shall say again in Chapter 3 that interest is not our goal. Our valid purposes are concerned with teaching understandings, abilities, attitudes, and appreciations, all of which are behavioral goals. But we must motivate our pupils to set up worthwhile purposes of their own. What we need to seek, then, is better, more lifelike, realistic, functional, and significant problem-solving activities if we wish to stimulate bona fide *interest*. This is precisely why the introductory film, filmstrip, slide set, taped program, television program, and demonstrations serve the teacher

so well in getting interest. Simply, it is because the content develops an awareness of groups of problems, opens up possibilities for exploration, presents meaningful information, and opens up avenues to new activity.

Teachers should, and they certainly will after working through this book, be aware of other possibilities for developing readiness in pupils. Other fascinating uses for audiovisual technology will be presented, a fascinating film experience, for example, in direct relation to a problem already set up and accepted by the class. A field trip, not taken on the indefinite basis of starting a new unit of work, but taken instead in response to a significant project for which committees need specific information, is another example. In this case the students' visit is the means for talking to people, making necessary observations, making sketches, and then returning to complete the job, feeling ready to tackle newer and still more difficult problems.

We urge teachers to vary the diet of methodology and to make audiovisual technology carry a heavier burden, much of the time, fully knowing that the potential power to help, in the introductory capacity, is always available as a possibility.

ROLE NUMBER FOUR

In accomplishing their objectives, teachers face great difficulties each day in presenting information in the form of the subject-matter content of courses, descriptions of required procedure for computation, analysis, and evaluation, and applications of principles. Other similar examples are legion. In a somewhat different view of this difficulty we see teachers trying to use effective media, other than the printed word, such as an apparatus demonstration, a model, or, for example, a part of the human skeleton like the cranium, but such materials cannot be seen by pupils

Figure 1-16. Special television presentations may be made live by unusually well-qualified studio teachers, or by video tape subsequently, to large audiences of students, thus eliminating the necessity for repetitive presentations by teachers in their small-group situations. (Courtesy South Carolina ETV Network, Columbia, S.C.)



in large groups, or even by people in the last rows of seats in a conventional size group. How does a teacher make use of a single important leaflet containing vital information that needs to be communicated? How does a teacher reveal the vein structure in a particular leaf, or the unique weave in a swatch of fabric, or show a single cartoon that appeared in the morning paper? How can teachers save the time spent each year on the same complicated chalkboard drawings? And sometimes teachers need to give different kinds of information and direct different learning activities in different groups within a class at the same time. How can this be done effectively? All of these are problems in communication, and, more specifically, these situations pose problems of display. Obviously audiovisual media, processes, and instruments can serve the teacher well. Hence we state Role Number Four as follows: *Audiovisual technology assists the teacher in overcoming physical difficulties of presenting subject matter.*

Now let us review the situations depicted in the preceding paragraph and show specific applications of technology. The teacher may:

1. Reduce the physical burden of lecturing, to present information by selecting and using television, motion pictures, tape-recorded presentations, by the optimum use of programmed learning sequences (tutorial process), and by the method of having individuals view filmstrips in combination with the use of pupil-response sheets.

Figure 1-17. Teaching machines are being used by this class, freeing the teacher for other professional activities. He is shown assisting a pupil, perhaps in difficulty, or having completed self-instruction ahead of the others, in working on a special assignment. This class is using the Koncept-O-Graph teaching machine. (Courtesy Graflex, Inc., Rochester, N.Y.)



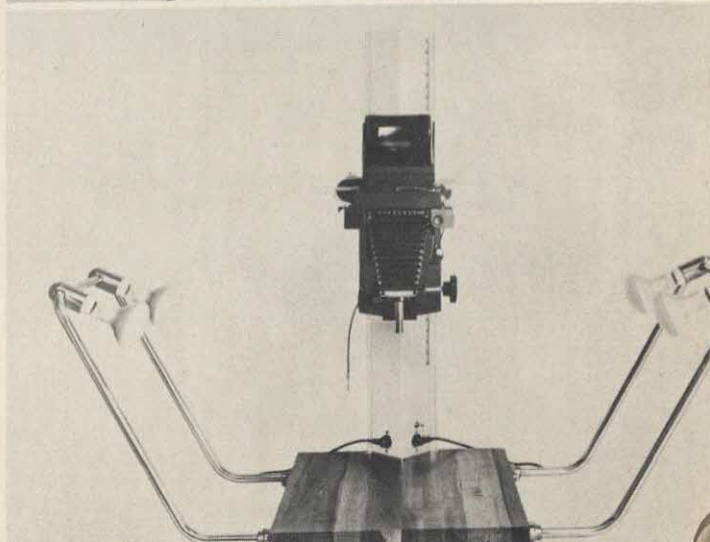
2. Project as needed personally photographed 2-inch by 2-inch color slides showing (a) crucial aspects of the process being demonstrated, (b) close-up views of cleavage between bones of the cranium, and (c) close-up views of a leaf to fill the projection screen, followed by microscopic slides in color of a cut-away section, using the 2-inch by 2-inch slide camera and a microscope attachment.
3. Use an opaque projector to project the single leaflet, or copy the diagrams, tabulated data, and pictures in three minutes using the Polaroid slide process medium.
4. Use an opaque projector to project the swatch of cloth or show a color slide of an extreme close-up view.

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Figure 1-18. This teacher is getting ready to make a Polaroid slide in $3\frac{1}{4}$ -inch by 4-inch size using the Polaroid Company MP-3 View Camera. Cartoons, maps, continuous tone prints, and other materials may be photographed, mounted in plastic frames, and made ready for projection in three minutes or less. Such slides may be bound between thin-cover glass plates and taped together in more permanent fashion. The view camera is shown here mounted on the stand that is equipped with its own photoflood lamp fixtures. See also Chapter 6. (Courtesy Polaroid Corporation, Cambridge, Mass.)



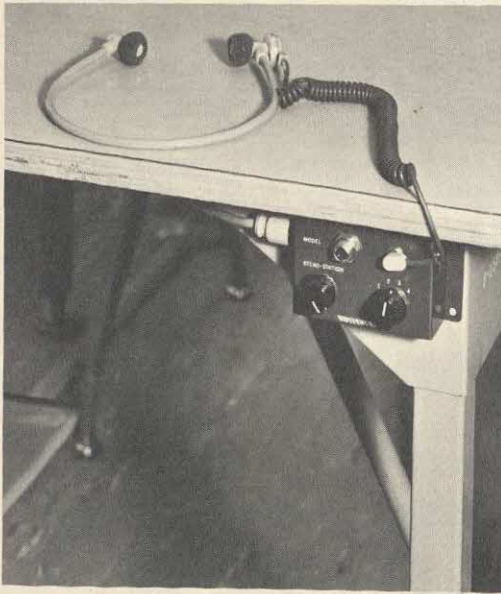


Figure 1-19. In this easy-to-operate stenographic learning laboratory students may select several different levels or kinds of tape-recorded content for dictation, or select sets of special instructions for controlled typing activities. The teacher may thus be freed from repetitive, laborious tasks, yet his own voice can guide students in a very personal way throughout a specified instructional task. Note the four tape recorders on the table at the front of the room, right. Note also, in the close-up view of the student station, that the lower right-hand selector switch has four positions. What does the schedule on the chalkboard have to do with this particular system? (Courtesy Switchcraft, Inc., Chicago, Ill.)

5. Copy the cartoon by means of the Polaroid slide process in three minutes, or use a photo-copying device to make a transparency on the spot for projection on the overhead projector.
6. Make complicated chalkboard drawings on a "master" sheet for making into diazo-transparency overlays, or draw directly on acetate sheets, or on colored paper for copying onto 2-inch by 2-inch colored slides, thus saving the time spent on redrawing each year.

7. Record content, questions, problems, and exercises at three different levels of difficulty for use on three different tape recorders with headphones to make possible simultaneous disturbance-free group listening and responding, thus permitting personal teacher work with still another group of pupils.

These are just a few of the examples of how audiovisual technology serves the teacher in overcoming physical difficulties of presenting subject matter. Another point should be mentioned here for both inexperienced and experienced teachers, and this has to do with cooperative endeavors. The use of audiovisual technology for improved display frequently offers the additional possibility of easy duplication of materials for exchange with other teachers. Processes for duplicating transparencies, slides, and tapes are well known as a part of the instructional technology.

ROLE NUMBER FIVE

This role has to do with pupil learning activities, energetic, significant, and appealing activities for pupils from kindergarten through college. Educational psychologists agree that it is what pupils do, how they react in their environment, what problems they solve, and on what they practice that is crucial. Teachers need to scrutinize continually the kinds of activities in which their pupils are engaging and to maintain a constant effort to improve and discover new problems for pupils on which to work, that is, problems involving sufficient scope and complexity to involve and consume the energies of a whole class of pupils, or problems that may serve as individual projects or as projects for small groups even working after school. This troublesome area of teacher endeavor has actually received from audiovisual technology a promise of assistance of vital character, but let us now state the role. Role Number Five is as follows: *Audiovisual technology provides the teacher with rich sources of pupil purpose when communicative materials are produced jointly by pupils and teachers.*

We must look sharply first at the term *pupil purpose*. By this term we refer to the specific problems and assignments upon which the pupils are at work, hopefully and happily having accepted them willingly. Thus we see that this role of audiovisual technology helps the teacher by opening up a vast new world of challenging assignments and pupil problems. Let us look first at a specific example. A ninth-grade civics teacher may work together with her group in planning and producing a set of color slides with tape commentary on bicycle safety to be presented to third-, fourth-, and fifth-grade classes. Would the young producers be likely to learn anything themselves? Acquire information? Acquire new



Figure 1-20. A number of groups of pupils in this class have engaged in this problem-solving assignment calling for constructional activity. Planning, wide reading, and fact-finding were involved, as were a number of different media, in portraying some aspects of California history. (Courtesy La Mesa Spring Valley School District, La Mesa, Calif.)

attitudes and appreciations? Do other examples come to mind at once? Why not have high school science students make a series of subject-matter tapes for elementary grade use on such diverse topics as good diet, hazards of drinking brook water while camping, prevention of colds, and so on. Or in other fields—good citizenship, good reading habits, historic shrines of the community, and how to be thrifty. Older elementary pupils and high school students might well make sets of slides, 8mm and 16mm motion pictures with magnetic sound tracks, a radio program, even a television program, live, on film, or simulated, or an exhibit for a store window downtown. If we think thoroughly about the entire gamut of the audiovisual technology field, we see that the possibilities for making models and exhibits, writing and producing plays, constructing model stores, post offices, and sand-table displays, making murals, charts, diagrams, and maps and globes as communicative materials are practically limitless for any one teacher. In the light of its huge potential the role of audiovisual technology for providing a new source of pupil problems and assignments is important indeed.

Figure 1-21. Problems and assignments may be large enough in scope to be worked on by all members of a class group, or they may be undertaken as projects for various purposes by individuals or smaller groups. The electric map shown was, in this case, a service project by two pupils for use by the whole class. (Photograph by Harry H. Haworth, Altadena, Calif.)



Figure 1-22. Youngsters like the challenge of planning, constructing, and operating post offices, stores, and banks. The dramatic activity involved broadens the scope of objectives to which such a project contributes. (Photograph by Harry H. Haworth, Altadena, Calif.)





Figure 1-23. This group of gifted eleven-year-olds made their own 8mm magnetic soundtrack motion picture, in this case as an after-school project. The pictures tell the story. Beginning at the top, the students are shown as they shoot their desired footage. Next they project some of their scenes. Then they edit and splice the film, record the narration, and view with pride their final product. See Chapters 3 and 6 for more details. (Courtesy Eastman Kodak Company, Rochester, N.Y.)

ROLE NUMBER SIX

This unique role became a possibility as new devices and new processes for those devices were developed in response to instructional needs. Emphasis in this role actually shifts to the instrument, as, for example, the tape recorder, the motion and still cameras, and the flashmeter. Role Number Six is stated as follows: *Audiovisual technology provides the teacher with a kit of tools to carry out diagnostic, research, and remedial work demanded by up-to-date instructional purposes.*

Uncovering and correcting weaknesses in student performance is a common teaching task in many fields from physical education to arithmetical computation. The teacher can help to discover faulty hearing, eyesight, and speech as well as increase the visual span for speedier reading and increased comprehension. The language or electronic learning laboratory with its listen, respond, and compare tapes is in a sense an automatic device that leads pupils to uncover their own difficulty and to proceed with remedial work as needed. This is also true of the teaching machine. But there are many more examples. A camera may photograph eye movements, speech gestures, and facial expression; an audiometer may indicate levels of hearing sensitivity; optical devices test for visual defects; a tachistoscope (slide or filmstrip projector and a flashmeter) may be used to remedy short visual span trouble in reading difficulties; and motion

Figure 1-24. This mobile electronic learning laboratory may help its teacher to identify certain speech defects. Then with taped exercises to which they respond, pupils hear and speak, and compare their own responses with those of their teacher. (Courtesy Radio Corporation of America, Camden, N.J.)





Figure 1-25. This is the EDL Controlled Reader, a device that leads the student to increase his reading speed. Content is presented by means of special filmstrips. (Courtesy Educational Development Laboratories, Huntington, N.Y.)

and still cameras may serve well in analyzing defective coordination as well as other physical weaknesses under game or other practical situations when instructors wish to develop remedial programs. In addition, the use of materials such as film sequences or still pictures may serve in the analysis and correction of such mental skills as observational and expressive powers under standardized stimuli.

Audiovisual Technology in the Learning Process

STUDENTS DESERVE GOOD COMMUNICATION EFFORTS

Students say they want teachers to use audiovisual materials, certainly not just because they are interesting and make time pass more quickly. Actually, most students want teachers to use audiovisual materials and to use them properly, that is, to relate them with telling impact to day-to-day class activities. Teachers who emphasize effective communication seek to give adequate explanations, seek to understand and anticipate the difficulties of pupils, seek to understand their influential subjective thought patterns, and seek to provide the necessary real and/or vicarious experiences for solving problems, building new ideas, insights, and abilities, and for carrying on other learning tasks.

When instructors develop penetrating insights into the breadth and variety of teaching objectives, when they understand better the difficulties in communication, and when they come to feel a real concern for student

achievement in both large and small groups, they will recognize more clearly the need for the help that audiovisual materials can give, help for the teacher that is rewarded in help for the student, help that is urgently needed if the learning process is to proceed efficiently.

In the preceding section we gave proper emphasis to the potentially great help that may be obtained by teachers through the use of audiovisual media. Now let us examine, in a new orientation, the help that they may bring to pupils in their immensely complex learning processes, thus gaining broader insight into the need for technology's benefits.

CONTRIBUTIONS OF AUDIOVISUAL MEDIA IN THE LEARNING PROCESS

We need not apologize in this section for the lack of a comprehensive analysis of learning theory, for, even if such a unified system had been discovered, agreed upon, and established, it would be far too detailed and complex for description and use in this book. It will be helpful, however, to identify the kinds of pupil action that many psychologists agree take place and then point out the contributions of audiovisual technology to this intensely subjective process.

We shall then, as a point of departure, describe a condensed and excerpted (perhaps oversimplified) view of the learning process, held by a particular psychologist, and then show how an instructional motion picture can function to facilitate desirable pupil action within that proposed model.

In the second edition of his book, *Educational Psychology*, Lee J. Cronbach described seven elements in behavior and asserted that "These seven elements . . . express in miniature a theory of behavior, and we shall also use them as the base for a theory of learning. Learning is shown by change in behavior, that is, by new interpretations and altered responses." These seven elements will serve our need admirably for an overall view of the learning process. Cronbach stated them as follows:

1. *Situation. The situation consists of all the objects, persons, and symbols in the learner's environment.* Experience in one situation prepares a person to respond to similar situations in the future. Curriculum planning is, in essence, the selection of situations (tasks, lessons, questions, objects) to which the pupil should learn to respond, and the arrangement of them in the best sequence.
2. *Personal characteristics. Under this heading we include all the abilities and all the typical responses that the person brings to the situation.* "Abilities" include such physical qualities and skills as strength, reach, and ability to swim, and intellectual attainments such as ability to hold a long sentence

in mind after one hearing. . . . The phrase "typical responses" . . . refers to what the person usually does. . . . These abilities and typical responses indicate how the pupil is likely to interpret and respond to a situation arranged by the teacher. Certain characteristics are needed if the pupil is to profit from the experience; we refer to this as the *readiness* required for the activity. If the pupil does not have the abilities and typical responses suited to the activity proposed, some other task must be found for which he does have readiness.

3. *Goal. The goal of the learner is some consequence (i.e., state of affairs) that he wishes to attain.* His desire may be for an object, a certain response from another person, or some internal feeling. The goal is defined by an opportunity or a threat he perceives in the situation. The person has many goals at the same time, and usually sees any immediate goal (such as completing an assigned task) as related to a whole series of future goals (earning a respectable grade in the course, finishing school, and succeeding in a career). Since goals direct effort, the teacher's problem of motivation is essentially one of arranging situations in which the learner will see goals he wants to attain.
4. *Interpretation. Interpretation is a process of directing attention to parts of the situation, relating observations to past experiences, and predicting what can be expected to happen if various actions are taken.* Interpretation may be conscious and deliberate, but a person makes many interpretations without putting them into words or giving them his full attention. The interpretation suggests what action to try. . . .
5. *Action. The person's actions include movements and statements; they are observable responses.* A person chooses whatever action he expects to give him the greatest satisfaction. . . .

If the learner is in doubt about his interpretation in a strange situation, he acts tentatively. We speak of his act as a *provisional try*. Then he is especially likely to look at the consequences of his act and to learn from them. This questioning, experimental attitude is one of the traits that sets apart the creative person, and the one who continues his learning long after he leaves school.

6. *Consequence: confirmation or contradiction. Some events that follow the action are regarded by the learner as consequences of it.* Consequences include the direct effect of the action, such as getting the basketball through the hoop, and less direct accompaniments, such as the popularity attained by a good player. If the consequences are those he predicted, the learner's interpretation is confirmed. Then he is likely to make a similar interpretation on another occasion. For the teacher, one of the important problems is to help the learner observe consequences accurately, and sometimes to arrange pleasant consequences so that correct interpretations and actions will be reinforced.

If the consequences are not what the person expected, his interpretation is contradicted and he does not reach his goal. He learns not to make this interpretation in the future.

7. *Reaction to thwarting: adaptive or nonadaptive.* Thwarting occurs when the person fails to attain a goal. If his first try is not confirmed, he may make a new interpretation and change his action. Through such *adaptive behavior*, he will usually hit on some action that brings him closer to the goal. At the same time, his goal may also be modified as he changes his idea of what he can attain.

The learner may instead respond nonadaptively, stubbornly repeating the same unsuccessful act, giving up entirely, or acting erratically and thoughtlessly. To distinguish between adaptive and nonadaptive behavior is difficult, because giving up, for example, is sometimes sensible.⁵

Now, by using a specific plan to utilize a motion picture in the classroom as an example, we shall point out relationships to the seven aspects of learning just described, emphasizing the facilitation of pupil action.

The Example. *A ninth-grade teacher of mathematics⁶ has set up and introduced a problem for her class in a unit on making graphs. The main problem is to construct a corridor display to show graphically the results of the school's Junior Red Cross Drive. According to the teacher's arrangements the pupils looked at the motion picture titled, "The Language of Graphs," after they had accepted and discussed their problem. The pupils then went to work, planning their action as individuals and as a group or team of workers.*

Relationship of the Film to Seven Aspects of Learning. We now point out some of the ways that the motion picture experience may have a formative influence as the learner acquires understanding, ability, attitude, and appreciation, which constitute the desired changes in his behavior. As the reader examines the following statements he should refer again to each of the seven aspects of learning previously quoted, *situation, personal characteristics, goal, interpretation, action, consequence, reaction to thwarting*. A word of caution is needed. The reader should not be tempted to view the seven elements as separate and distinct steps. They are interrelated and interwoven, but are separated for discussion.

SITUATION ASPECT. The motion picture became a part of the situation that included problems, books, and all classroom arrangements. The assignment or problem became an obstacle, and pupils looking at the film in this framework of reference had a realistic experience. (The film was about another group of school students in a similar situation.) As they watched the action they received suggestions (stimuli, cues) for directing their own constructional procedures later. As students make responses

⁵ From *Educational Psychology: Second Edition* by Lee J. Cronbach, copyright, 1954, © 1962, 1963 by Harcourt, Brace & World, Inc. and reprinted with their permission.

⁶ Marilyn Neri. Farmington High School, Unionville, Conn., based on a film utilization plan prepared for the author in 1963. The film, *The Language of Graphs*, is a Coronet Film production.



Figure 1-26. These views are from the film, *The Language of Graphs*. This film tells the story of another high school group planning to use graphic means for promoting an increase in the circulation of their school newspaper. (Courtesy Coronet Instructional Films, Chicago, Ill.)

during their viewing in terms of questions and directions introduced before the film showing they may know at once if they are correct, and hence may receive reinforcement from supporting action in the film story. The film experience would very likely appear to be meaningful to the students because of their needed understanding and skill. They may recognize the need for other sources of information and direction such as their textbooks. In this film pupils saw specific examples of what graphs do, and they probably eventually generalized about graphs as a vital aid to effective communication. As a result of the film experience, pupils knew their own situation better and were thus able to choose or suggest a wise course of action. It is also very likely that they recognized and defined new personal needs.

PERSONAL CHARACTERISTICS ASPECT. Certainly this class of young mathematics students, with all of the wide diversity among its members, was together in its *readiness* for action focused on the problem to be solved by the group, and focused on the film experience with its realistic source of information. It is likely that the film experience intensified or reinforced the readiness of pupils to attack their problems and to study their texts for additional facts and directions principally because of increased insight developed by watching their own peers in a similar problem situation. Naturally, the work of pupils was carried on in the light of their own differences, strengths, and weaknesses.

GOAL ASPECT. The goal of pupils—in this case was to complete the basic problem. Watching the film was an important step, that is, a means of getting from the film needed information (as guided by the teacher). Other goals as well doubtlessly operated in this situation. (Refer to the quoted statement.) The importance of motivation in each pupil must be recognized. In this situation, pupils were motivated primarily

by a problem that they had accepted before use of the film. The motion picture helped the student to become more aware of the nature of the main goal, thus intensifying motivation through reinforcement. (We should point out that the *Language of Graphs* film portrayed the activities of a high school group concerned about a communication problem of increasing the circulation of their school newspaper.)

INTERPRETATION ASPECT. As the pupils observed and reacted to the action in the film they very probably identified themselves with the decisions and actions of the film actors. The experience helped them to interpret and define their own goal. Pupils were stimulated, in the process of interpretation, to suggest a plan of action for the group, and to conceive of several possible individual contributions of effort. Thus the film experience facilitated the process of interpretation, and, under the guidance of the teacher, they responded with ideas for action, for the group and for themselves.

ACTION ASPECT. The action suggested as a first attempt is of course met by consequences, confirming or contradicting. Pupils in the group suggested plans for study and construction. A display design took shape, and work groups were organized. The necessary work demanded text study, discussion, extensive practice, practice working in a group, and development of skill to collect and arrange data, to make computations, and to construct graphs. Throughout such activity pupil actions are being affected by group criticisms. It is, of course, in this action by pupils that insight and ability, attitudes, and appreciations are being shaped. Films, books, models, charts, the teacher, and classmates thus now contribute to pupil action, action that is a complex of pupil response, new responses as a result of experience, vicarious experience in the film, and real experience in solving the functional lifelike problem. Such successful action is intended to prepare students for increasingly more complex problem-solving behavior in an endless stream.

CONSEQUENCES ASPECT. In this particular aspect of a group project there is a series of consequences to which pupils react. Some of their ideas are accepted by the group with reinforcing effects, and others may be refused, hopefully leading to new and better responses. Some of the students' unexpressed ideas may have been reinforced during their observation of film action. Actually, the film, through its concrete imagery and interesting and realistic action, probably served the pupils well by facilitating a high rate of correct choices. However, here much individual study and work was called for following the film, as needed insights and skills were acquired as the project proceeded toward completion. Hence the pupils likely had to face the consequences of their individual actions as well as the action undertaken by the group, constantly until termination of the project.

REACTION TO THWARTING ASPECT. Pupils who were forced to modify their action and to make new trials to gain success may have been guided by their impressions of film content. Under a strong motive, and under guidance of the teacher and help from classmates, those pupils who did not master the techniques were led to engage in more practice as the solution of the problem neared completion. Guided study sheets and homework assignments were suggested and made available. Thus desirable, adaptive behavior was reinforced. (But unfortunately, by the same process, under certain circumstances, it is also possible for non-adaptive behavior to be reinforced.)

Admittedly, this example has been oversimplified and condensed to facilitate emphasis on the points of relationship to each of the seven aspects of learning. As has already been pointed out, a number of different audiovisual media are frequently used by a teacher, each medium making its own systematic and planned contribution at different stages of activity in the class. Also, many other examples of the use of audiovisual media may have been chosen instead of the one in this example. A prerecorded language laboratory tape for guiding pronunciation, or a combined system of media including overhead transparencies, a motion picture, a filmstrip, and illustrated exercise books for a group of students in a typewriting class, would have sufficed for our purposes. In fact in Chapter 4 the reader will find a number of well-defined case studies of technological media used in classrooms, and all of these, should the reader wish to do so, may be analyzed in the light of the seven aspects of learning.

Before we depart from this particular learning-process orientation, attention should be called to a number of other pertinent considerations, some of which have already been implied. These matters have to do with the way the motion picture experience in the learning-process-analysis example, in particular, and experience in general, may influence the acquisition of concepts, generalizations, abilities, and attitudes.

It is imperative that teachers seek to understand that new insights arise when we relate old experiences to the new, that insights are of personal origin, and that the process of putting together a group of specific and meaningful experiences into a generalization is a thrilling, personal discovery. But the reverse of this inductive process is also frequently necessary for rich understanding for the learner. In this case the learner finds it necessary to reconstruct his generalization by identifying and assembling the elements of the personal experiences and observations that made his generalization possible. It is imperative for teachers to understand that the process of generalization applies to the synthesis of values, the drawing of conclusions, the growth of an attitude or an appreciation, and to the learning of abilities as well, and that the use of language in this subjective process of formulating generalizations is crucial.

If we review the learning-process analysis, we note the following vital aspects of the classroom action that have a bearing on the development of generalizations, abilities, attitudes, and appreciations:

1. The students worked on a problem that had meaning for them. They were highly motivated. The film experience was related to the arrangement of conditions. Such a functional problem-solving situation is likely to be conducive to formation of concepts and subsequent generalizations.
2. Pupils worked individually in building skill in planning and constructing graphs, and they also worked in groups on display planning and construction. Hence the problem's solution called for complex activity, resulting in the drawing of conclusions, the development of insights into graphic processes, and the building of constructional ability.
3. The film about people and similar problem activity must have seemed highly realistic and thus strongly motivating in its effect on continued activity in depth.
4. Opportunities were provided to link conclusions from past experiences with new ideas under the stimulus of the group and individual activity. This process also has a marked influence on development of concepts and generalizations.
5. The film action supplied information as to how to proceed to make graphs, presented high quality finished products to serve as standards for class achievement, stimulated the desire to consult other sources such as textbooks, aided pupils in setting up specific personal goals, and stimulated them to work toward achieving those standards. All of these influences would foster the development of both ability and attitude as well as concepts and generalizations.
6. The span of work on skill-building activity plus the planning activity by the group, and the possible satisfaction by successful display completion, probably provided opportunity for extensive feedback, or knowledge of results, and opportunity for imitation and interaction in a varied experience that involved visual imagery, language activity, and motor and emotional activity.

It is in situations possessing such elements of action under strong motives, where perhaps both successes and failures are made possible, where group and individual pressures are operating, and where desirable value systems are in evidence, that pupils may be led to reorganize experience through language into meaningful generalizations.

We have looked at two briefly stated orientations for perceiving value in audiovisual technology in this section, namely, those of the teacher and the pupil. We must point out, however, that this book focuses on the teacher and his decisions, and, although teacher decisions have to

be grounded in what is known about learning, this book does not try to describe the psychology of education. The study and close observation of the learning process needs to be a part of every teacher's lifelong professional endeavor. We do maintain that the fundamentals stressed in the following pages of this book possess a rich potential for effective teacher prediction, planning, and action. We state not a recipe, but rather a pattern for teacher creativity in incorporating audiovisual media in arranging the conditions for learning.

In the next chapter we shall discuss and illustrate the various audiovisual media to which teachers may turn for help.

Problem-Solving Activities

1. Review some of your high school class experiences as a junior or senior and make a list of three specific motion pictures that your teachers used. List them, if you can, by subject and teacher. Now study the basic roles in the preceding pages and answer the following questions, or add notes to your list as requested:
 - (a) Identify the specific roles that the films played.
 - (b) How many film showings in your list seem to have been held for reasons other than those stated in Roles 1 through 6. Can you name one? Was it a valid reason?
 - (c) How may books play Role 1? Role 2? Role 3? Role 5?
2. Study Roles 4, 5, and 6 in the text and cite an example from memory either from elementary, high school, or other college classes. Under which of these three roles would the writing and production of a dramatic sketch fall? Planning and making a mural? Can you identify additional learning activities (problems) of this nature from your own school experiences that you yourself engaged in?
3. Would the expression *educational media* be inclusive enough to encompass *audiovisual technology*, *audiovisual materials*, *instructional materials*, *printed materials*, *instructional technology*?
4. Does the term *technology* refer strictly to the instruments or hardware alone?
5. Do you believe you deserve good classroom communication in your present college classes? What vicarious experiences beyond reading should be provided? Do you want your instructors to use a variety of good teaching materials? How are such materials likely to help you learn?
6. Is it correct to think of audiovisual materials as sources of *experience* for pupils? Just what is the concept of experience? Have you seen one of the Cinerama productions yet? If not, your understanding of the reality that

can be found in audiovisual materials is probably not fully developed. What do you suppose would make an audiovisual presentation seem realistic to a pupil?

Available Technological Materials for Class Use

Debt to the Past: Language and Communication. 16mm motion picture. Moody Institute of Science. Color. 16 min. (To illustrate audiovisual materials as sources of information.)

Fundamental Skills in a Unit of Work. 16mm motion picture. Bailey Films. B & W or color. 21 min. (To illustrate specific ways audiovisual materials fit into a larger pattern of instruction such as a unit of work.)

Nomads of the Jungle. 16mm motion picture. United World Films. B & W. 18 min. (Use as an "experience" film.)

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2

THE ARRAY OF INSTRUCTIONAL MEDIA

The medium for instruction that most of us, in fact all of us, know best is the textbook. But today and since the day of Comenius, Basedow, Rousseau, and the St. Louis Exposition of 1903, we have had a continuous stream of new media for real and vicarious experience. No one medium has yet established itself through common practice as securely as the textbook. Recently, however, with the advent of the teaching machine and its technology, it has been said that the textbook as we know it will play a new role, that of storing information, thus surrendering in part its unique role of being the intimate everyday oracle for our school-attending millions. The new programed book, the television process, and the film, for the large group or for the individual, are coming into prominence at an accelerated rate. The textbook and the library must now in fact share the limelight of instructional attention, and teachers need to identify their modified, but nevertheless vital, roles in the new instructional designs born of the new technology.

Hence we now turn to a portrayal of this array of media that has been the product of the industrial, electronic, and communication revolutions. There are many media, sometimes involving different categories of materials and instruments, which teachers need to learn about and choose, sometimes singly and sometimes in systematic combination, to achieve their objectives. In past decades these materials and instruments have been referred to as teaching tools. We shall combine and interchange the terms in view of the link with tradition and refer to media as particular kinds or groups of materials arising from technological development and now used in the teaching process. However, it will be helpful if the reader is aware that projectors, tape recorders, chalkboards, and bulletin boards are means of display, that is, means for putting content materials to work; and that such materials as models, and such processes as field trips and dramatizations, need no instrumentation for their utilization in teaching.

Later, advice will be given about procedures for using the media effectively, and, since all of the needed materials are not available commercially, they will have to be made by the instructor, or by other service agencies under his direction and according to his specifications. Suggestions about such preparation will also be given in a subsequent chapter. Now, however, technological possibilities are pointed out under two headings, namely, (1) the traditional media, and (2) the media of more recent development.

The Traditional Media

THE MEDIUM OF REAL THINGS

Everywhere in our environment real things become sources of content and serve as stimulators for learning when we study, handle, taste, and



Figure 2-1. These Los Angeles biology students are dissecting a heart supplied by the science center. How would this learning activity contribute to concept development? To observational skills? To understanding and insight? To scientific attitudes? To appreciations? How should learning conditions be arranged to facilitate such pupil action? (*Courtesy Los Angeles City School Districts.*)

manipulate them. The real things we speak of may include such diverse objects as an Indian arrowhead, a ship's pilot, or a banker. We therefore readily identify all kinds of specimens, both animate and inanimate—equipment, buildings and construction; every business concern and agency; every bee and bird's nest; every stream, rock, spring, mountain, and valley; every ship and plane; every plant and animal; every fossil and every bone.

We must learn to select and use these real things in unique ways. Teachers need to consider and provide the situation where pupils may have intimate contact with some of the objects brought in for study, for example, breaking a crystal of Galena or Calcite, and holding for a guarded instant a piece of dry ice. But, of course, some real things are so precious that they must be locked in glass viewing boxes. But detailed observation nevertheless should be conducted at close range. Hence we study real things formally as class groups most realistically by the process of the field trip, and we bring them to school for scrutiny where we are not as hampered by limitations of travel and time. In our classrooms we put some of these real things in exhibit cases; others we suspend by wire or arrange on tables and shelves; for some real things we use apparatus to experiment with them and demonstrate their properties. We study about them in library books and texts, and it is hoped that we will observe them until we can draw significant conclusions about them.



Figure 2-2. Should conditions be set up to facilitate the practice of creativity? Just for elementary schools? How should pupil productivity at all levels in all subjects be encouraged? (Courtesy Los Angeles City School Districts, top picture. Bottom picture, photographed by David H. Curl, The University of Connecticut, Storrs, Conn.)



The use of real things as a basis for observation in the classroom makes possible an accuracy of impression and concept that other materials cannot match. But the limitations in their use are obvious. First, it is difficult to arrange for simultaneous observation by all pupils, if, for example, there is only one case of mineral crystals available; second, we cannot actually bring most of the things we need to study into the classroom, nor do we believe we can reorganize the classroom schedules extensively enough to permit the necessary volume of out-of-school study activity. It should be emphasized that we must arrange for enough study of real things to permit pupils to deal with successive levels of increasing abstraction.

We single out the process of the field trip for later additional study in

Chapter 5 to point out to prospective teachers the easy way to organize and conduct such formalized out-of-school activity for maximum instructional gain.

THE MEDIUM OF MODELS

Although the study of real things in their social and physical environments is valuable, the difficulties for formal study are often insurmountable. It is then that teachers turn to representations of real things by buying and/or making models and mockups of them, the latter representation being differentiated from models by their moving and operating parts (i.e., a wooden model of a gun that ejects a shell). Apparatus setups used at all levels of instruction, but perhaps most common in science

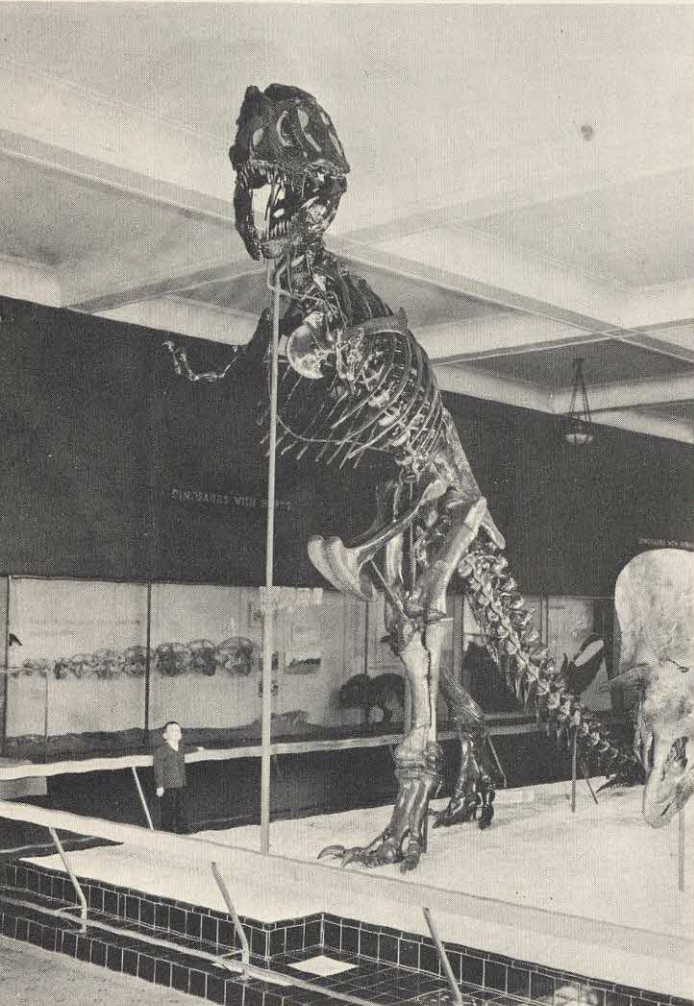


Figure 2-3. Field trips to museums may be the only way possible to study such real things as shown in this picture. Pictorial and diagrammatic representation of such real things, or small models of them, may have to be used as substitutes. This picture shows the mammoth skeleton of the Tyrannosaurus Rex. (Courtesy American Museum of Natural History, New York, N.Y.)



Figure 2-4. These youngsters may have direct contact with this model of the human heart as they make their observations and write their answers to questions. Models are easy for teachers to use in the classroom, but opportunities for close study by pupils need to be organized. (Courtesy La Mesa Spring Valley School District, La Mesa, Calif.)

classroom activities, are often the counterparts of natural objects or of industrial machinery and components.

In a somewhat extended meaning a model post office, store, or bank may be organized and operated in a classroom; pupils may become “models” of people in dramatic portrayals as they engage in role-playing situations or re-enact historic events. Class groups, from nursery school youngsters to college students, make models as learning activities, ranging from a space craft from a box to a complex mathematical or atomic model. Biology teachers not only use preserved specimens as examples of the real things, but they also use life-size, torso models, or a model of the human ear that can be taken apart. Pupils and teachers have the benefit of professionally made exhibits and dioramas in well-developed instructional technology service centers, and many times these complex dioramas and sand-table displays are constructed in the classroom as significant learning activities. (See Role Number 5, Chapter 1.)

We must remember that models offer one kind of short cut or substitute for the study of real things, and frequently the representation of the real may be more effective than actual study in the field. Aside from the fact that one cannot always actually visit a glacier valley, or travel by air to a building in Rome, a model may clearly show the striking features that may constitute the essential elements of understanding. Indeed the relief map and globe may be far more effective in developing required

insights than trips over large expanses of the earth's surface. Hence we speak of the medium of models as a vital adjunct of the array of technological materials now available to teachers. The value of such materials may never accrue, however, unless teachers arrange viewing conditions for clear observation and full comprehension, and unless they plan and organize problem-solving activity of a vital, functional nature for the pupils for whom the materials were procured. Special teaching practices characteristic of this medium are therefore suggested in Chapter 5. Also, we should emphasize that the five basic principles stated in Chapter 3 apply to models as well as to other media such as the diagram, picture, and film.

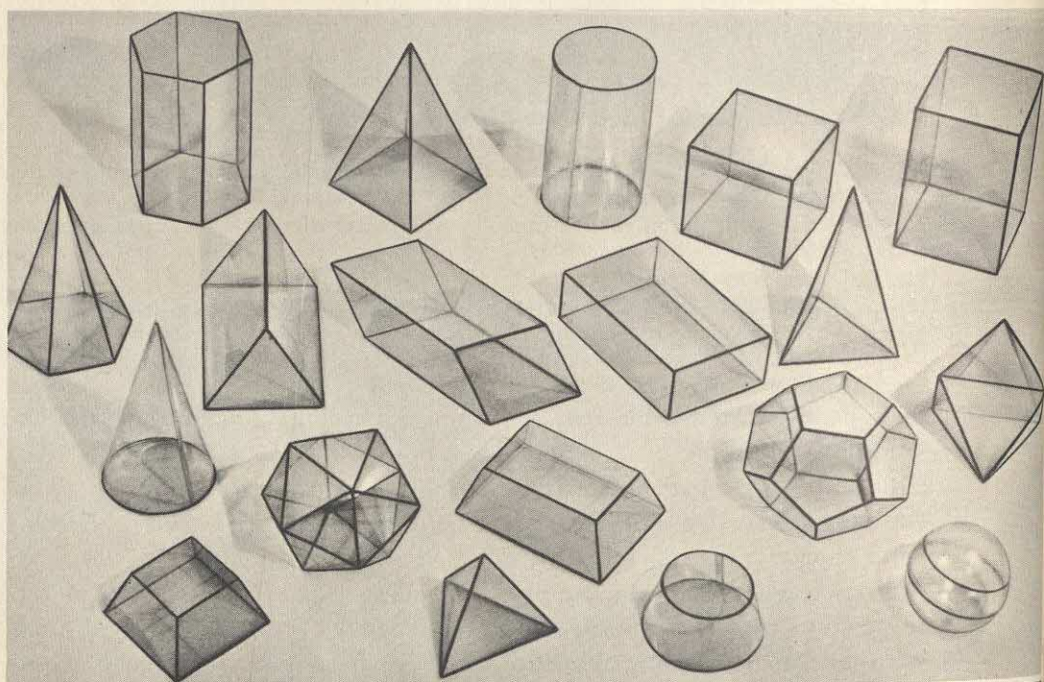


Figure 2-5. Models for mathematics shown above may be labeled with grease pencils. Some of the models in this set are approximately four inches high. The small geometric solids set consists of six equal-volume models. (Courtesy Edmund Scientific Company, Barrington, N.J.)

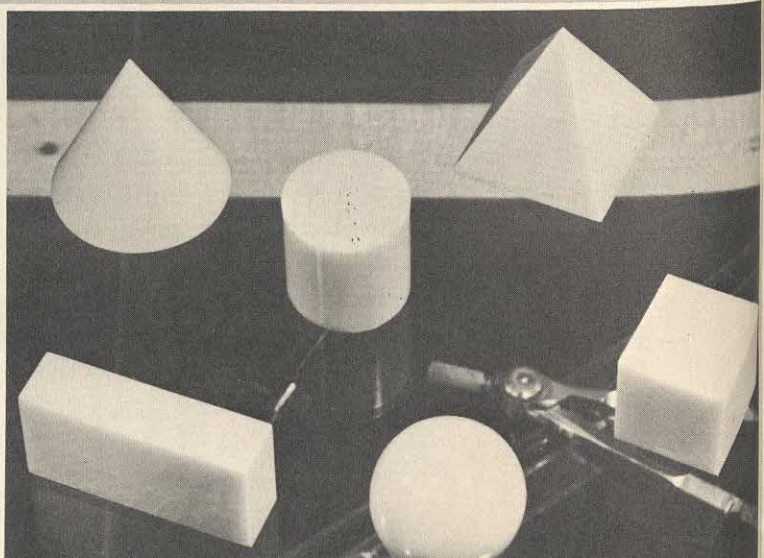




Figure 2-6. Models may be made by students as significant learning activities, see Role 5, Chapter 1. How much information is needed before accurate models can be constructed or created? (Photograph by Harry H. Haworth, Altadena, Calif.)

Figure 2-7. The use of models may become a part of other learning activities, as, for example, the project globe in this classroom situation. A globe may, of course, be considered as a model of the earth. (Courtesy A. J. Nystrom & Co., Chicago, Ill.)



THE MEDIUM OF GRAPHIC SYMBOLS

In a broad sense *graphic* refers to all representational materials, but in discussing this technological-instructional medium we refer to graphic symbols or signs that are non-pictorial in nature. Hence we identify for consideration such teaching materials as maps, graphs, cartoons, diagrams, and charts. We speak of teaching pupils the abilities to interpret maps, to organize information, and to present ideas in graphic form. We teach our pupils to produce and to read them.

The medium of graphic symbols often requires opaque slide and transparency projectors because they are often prepared as projectuals. But also we display them on flannel boards, bulletin boards, and chalkboards. Graphic materials may thus serve the teacher as a communication medium when he prepares them, or they may open up the same valuable process to pupils when we encourage and guide them in communicating similarly with their peers, or with adults, as a part of significant and challenging class-room-learning activities.

Frequently teachers use graphic symbols, assuming that pupils know as much as they do about the reality the diagram represents. Herein lies

Figure 2-8. Rich map resources are vital in our classrooms, and the ability to use such resources effectively is among our crucial educational objectives. The kind of problem-solving activity where pupils need to practice getting needed information from a wide variety of available maps is recommended. The organization of conditions to facilitate accurate observation and study is crucial. (Courtesy A. J. Nystrom & Co., Chicago, Ill.)



Color Plate 1 (right). The medium of models here represented by this lifelike, intricately sculptured, take-apart human torso provides students with a reference basis for study and observation. What objectives could be set up by a teacher for the use of such models? What assignments and problems could be worked out by the teacher for significant pupil activity to achieve those objectives? Should models like this be left uncovered and otherwise available for use by pranksters when not used for formal class study? Below is biology chart No. JBS 13, titled *Monocotyledonous Stem*, from the Jurica Series. The graphic symbol medium saves time in making clear explanations and presenting information, but details should be visible, and care should be exercised in checking students' concepts of reality before and after the use of charts to prevent the forming of misconceptions. (Courtesy A. J. Nystrom & Co., Chicago, Ill.)

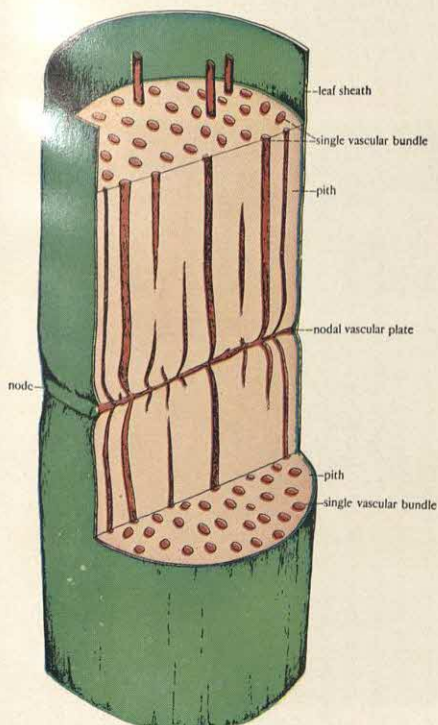
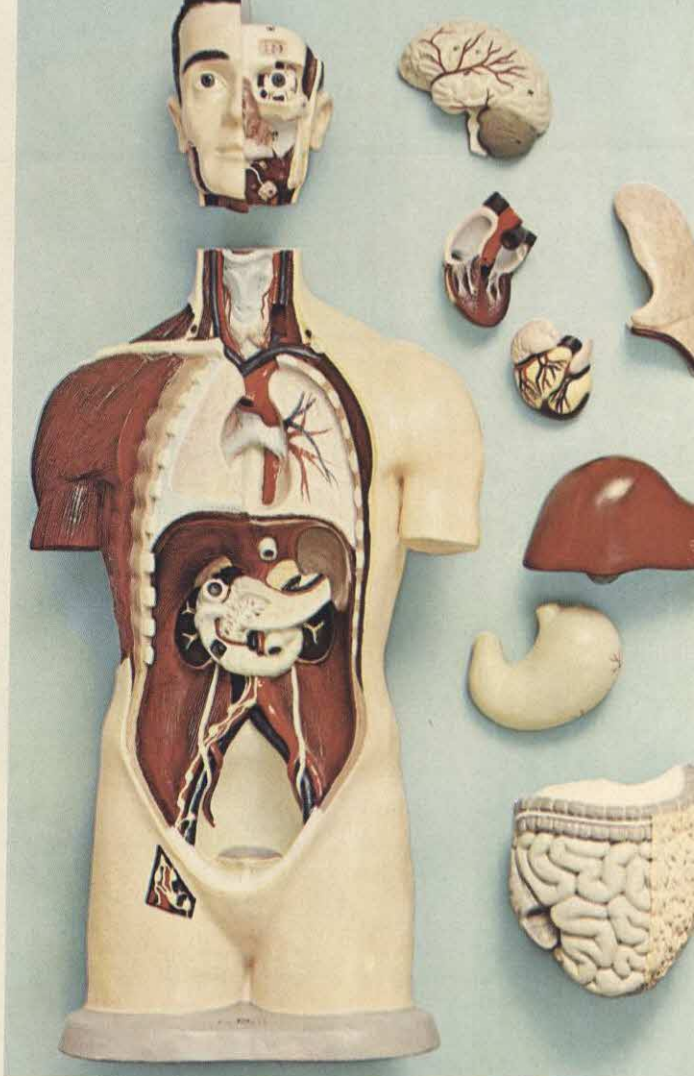
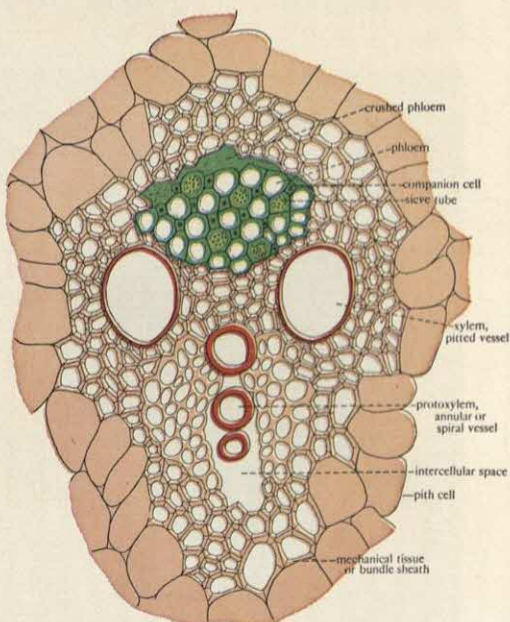
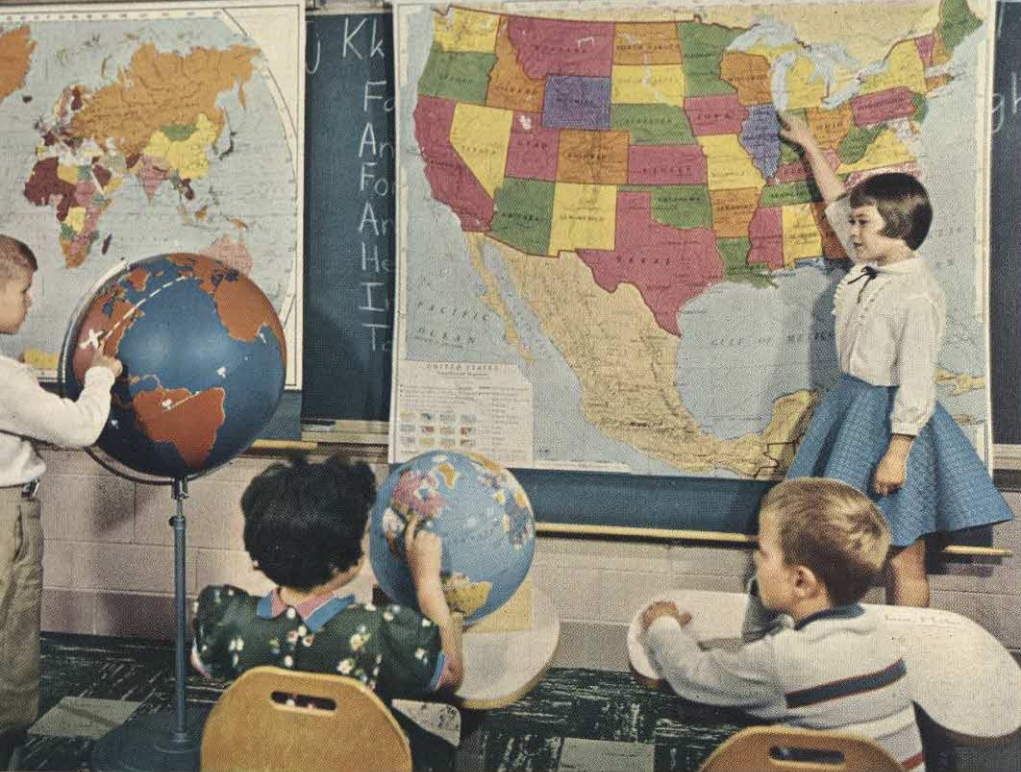


DIAGRAM OF A CORN STEM, A MONOCOTYLEDON, SCATTERED VASCULAR BUNDLES

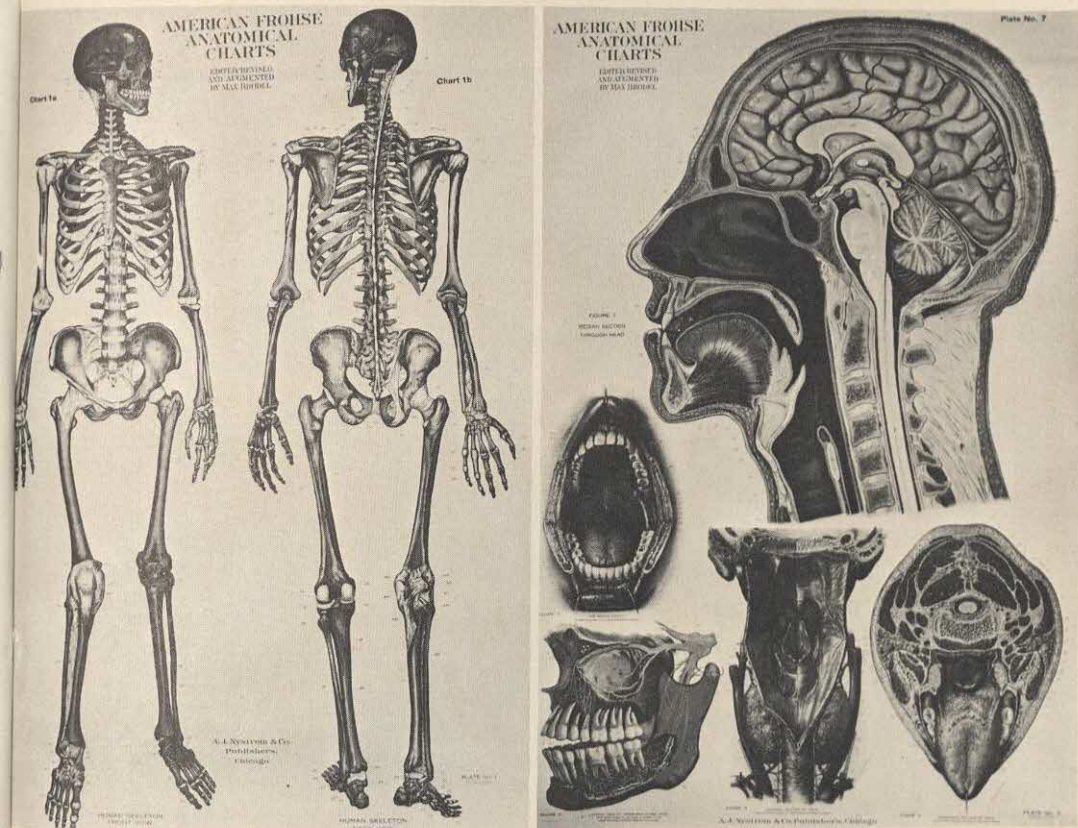


VASCULAR BUNDLE OF CORN IN CROSS SECTION



Color Plate 2 (top). In this situation, pupils have a wide variety of maps and globes available for study. Note the small study globe in its wood-cradle mounting and the graphic-project globe on its mobile stand being used in combination with other wall-type maps. Below this strikingly realistic picture, which is rich in colorful detail and 21 inches by 30 inches in size, as well as other pictorial media may be the basis for challenging activity by students working singly or in small groups. Might students be encouraged to make comparison of the Rhine river as shown with the Hudson river valley in the United States? Might not such similar pictures as *Naples and Vesuvius, Italy*, *Norway Fjord*, and the *Grape Harvest, France*, make significant contributions to the development of geographic concepts? Serve as a basis for serious library study and fact-finding? (Courtesy A. J. Nystrom & Co., Chicago, Ill.)





the real limitation, namely, the present knowledge and experience of the learner. Teachers therefore must ascertain that pupils comprehend the reality that diagrams and maps, for example, are presenting. That is, just what facts, conditions, and relationships do the lines, symbols, and colors represent. Everyone of course knows that the ability to interpret maps, that is, to use maps as sources of information, must be painstakingly and directly taught to pupils.

Charts and diagrams large enough to be seen by students in the back rows are expensive to have made, and of course they are hard to preserve for repeated use. Hence instructors turn to slides and transparencies, or they spend long hours at the chalkboard each year sketching the same drawings. The recommended procedures that are most economical of time, effort, and money are regular photographic and diazo-ammonia

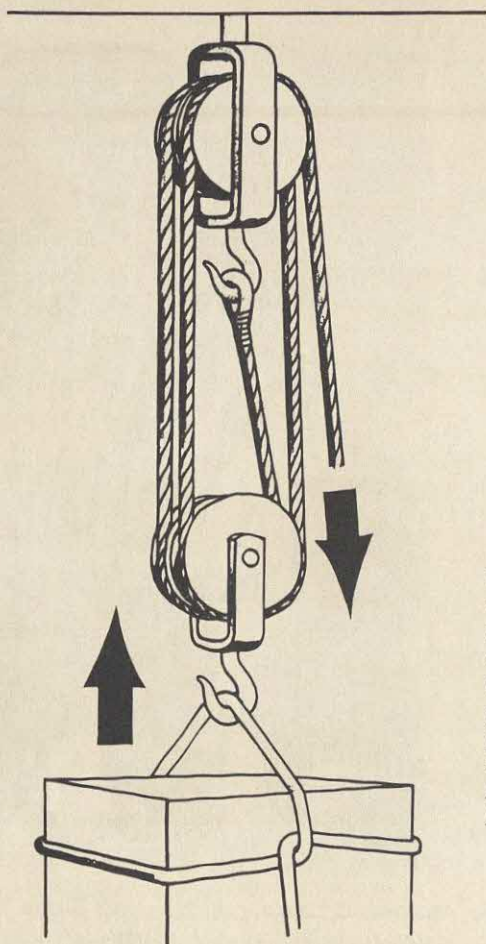


Figure 2-10. This diagram is a part of a set of study prints, 14 inches in size. Sometimes it is an advantage to prepare diagrams without labels, thus permitting a broader range of pupil study activity. Naming the parts, for example, in a testing situation is one example. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)

processes. If flip charts are employed, teachers should themselves use, or tell their suppliers to use, large letters and numbers that are readable in the last row of students. The chalkboard as a display medium for symbols, both verbal, numerical, and graphic, calls for special teaching techniques, and these will be pointed out in Chapter 5. Instructors are also reminded of the value of pointers to focus attention of viewers for projected, non-projected materials and for chalkboard diagrams.

Again, once the ability exists to profit from study of graphic symbols, the five basic principles of Chapter 3, as well as the basic roles in Chapter 1, guide teachers in their on-the-spot presentation and use of this familiar medium.

THE MEDIUM OF MOTION PICTURES

50 Motion pictures may provide intensely realistic experiences for pupils, and it is hoped that many more excellent films will be added to the thou-

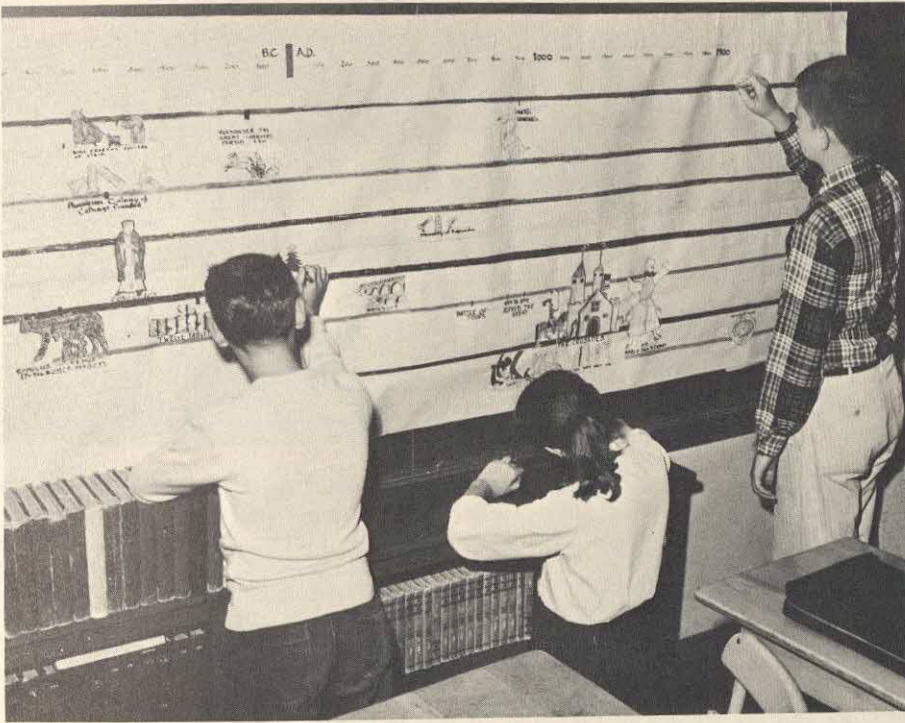


Figure 2-11. Students need to engage in a host of creative, productive activities, based on planning and research. Making diagrams, charts, and posters for a wide variety of uses in school classrooms, corridors, and libraries may be the means of accomplishing valid teaching objectives. (Photograph by Harry H. Haworth, Altadena, Calif.)

sands already available that have been produced for specific levels and for pinpointed experiences and teaching purposes. Skill-building films that give directions for action, films that show processes, define problems, and show people at work, and films that show continuities otherwise unobservable may, if properly used, play significant roles in teaching and learning. These roles are listed and described in Chapter 1.

Film experiences need to be chosen with full awareness of their possible relationships to the teaching-learning process, but in this respect they are not different from any of the other technological media. Above all, teachers must realize that films differ widely in their internal characteristics. Some are intensely real in dialogue and pictorial and dramatic treatment; some are devoid of the "action" that characterizes the medium; some are not pictorial in image, but are graphic in diagrammatic animation, or highly symbolic of the reality they seek to portray; others are illustrated lectures, straightforward presentations by chart, diagram, and voice of any given segment of knowledge, as a paragraph or chapter in a

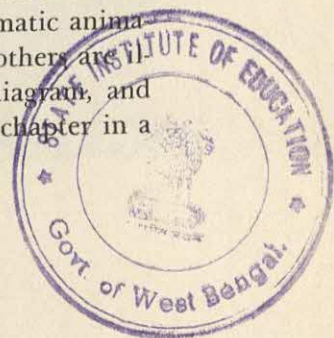




Figure 2-12. One of the capacities of the film medium is its potential nearness to reality, and hence it possesses the potential power to move people to far-away places for close observation. Its major purpose is to reveal continuity and action. This picture is from the motion picture *Greece: The New Age*. (Courtesy United World Films, Inc., New York, N.Y.)

Figure 2-13. A valuable source of information for history classes is the available motion-picture footage of actual historic events. This scene is from the record of a meeting between Churchill, Roosevelt, Stalin, and their aides, now incorporated in the Encyclopaedia Britannica film, *Second World War: Allied Victory*. (Courtesy Movietone News, New York, N.Y.)



book; some are usable at one level only; and others may be adapted for use at many levels.

The film is indeed a complex medium, and it is unique in that it combines three components of portrayal, namely, motion, sound, and realistic images in black and white or color. When these elements for effective communication are skillfully blended by a film producer, viewers may respond much as though they were experiencing the real situation instead of its representation.

Figure 2-14. Pictures in this group are from the Encyclopaedia Britannica films, a family scene in *Japan: Miracle in Asia*, harvesting rice in *Japan: Harvesting the Land and the Sea*, and a little boy praying in *Japanese Boy: The Story of Taro*. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)



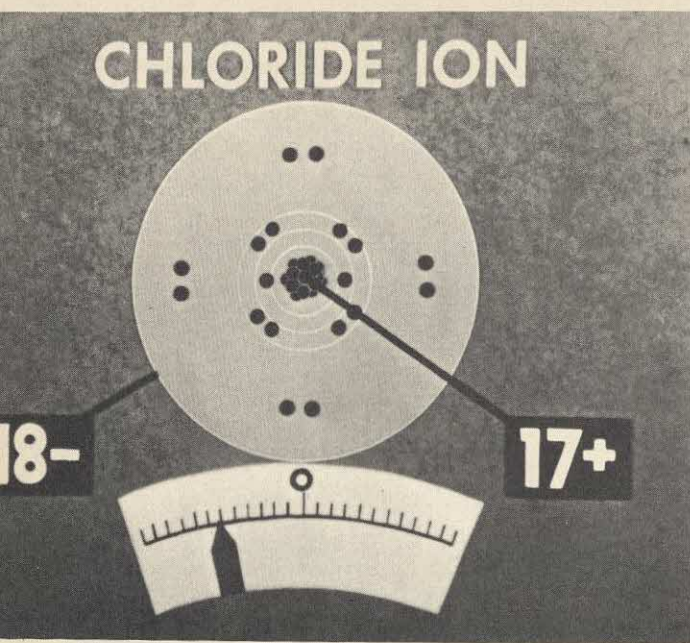


Figure 2-15. Motion pictures may by diagramed action show the unobservable. Charts and diagrams are made to move by a process called animation. This chloride-ion diagram from the film, *Chlorine: A Representative Halogen*, is an example. (Courtesy Sutherland Educational Films, Inc., Los Angeles, Calif.)

Figure 2-16. This close-up view of elephants is from the film, *Animals of the Indian Jungle*. (Courtesy Encyclopaedia Britannica Films, Inc., Chicago, Ill.)



The range of such experience through the motion picture medium is greatly increased by the process of miniature photography as applied, for example, to the filming of accurate models and changes in them, such as the erosion of a steep bank by a river. Animation techniques constitute another striking contribution of the film medium to teaching whereby generally unobservable action and changes may be skillfully portrayed in diagrammatic form. Still another feature of this medium is the potentially valuable process of altering the time reference for any action sequence. Thus an object moving too fast, such as a rifle bullet, and an object moving too slowly, such as a leaf of a plant moving toward the light, may be slowed down or speeded up to facilitate observation.

It is fortunate that a growing body of research is available to guide teachers in their efforts to understand and use motion pictures. Hoban and Van Ormer, after painstaking work in collecting and analyzing findings of researchers from 1918 to 1950, formulated ten principles that indicated the nature of the influence of the motion picture. The principles and a brief excerpted explanation of each are quoted here, in perhaps oversimplified form; however, the reader will be quick to recognize relationships to his professional coursework. Thoughtful consideration of these principles will facilitate comprehension and creative application of the five basic principles of utilization stated and analyzed in the next chapter. The statement of Hoban and Van Ormer's principles of film influence follows:

1. **PRINCIPLE OF REINFORCEMENT:** *Films have greatest influence when their content reinforces and extends previous knowledge, attitudes, and motivations of the audience. They have least influence when previous knowledge is inadequate, and when their content is antagonistic or contrary to the existing attitudes and motivation of the audience.*
2. **PRINCIPLE OF SPECIFICITY:** *The influence of a motion picture is more specific than general.*
3. **PRINCIPLE OF RELEVANCE:** *The influence of a motion picture is greater when the content of the film is directly relevant to the audience reaction that it is intended to influence.*
4. **PRINCIPLE OF AUDIENCE VARIABILITY:** *Reactions to a motion picture vary with most or all of the following factors: film literacy, abstract intelligence, formal education, age, sex, previous experience with the subject, and prejudice or predisposition toward the subject.*
5. **PRINCIPLE OF VISUAL PRIMACY:** *The influence of a motion picture is primarily in the strength of the visual presentation, and secondarily, in the narration or commentary. It is relatively unaffected by "slickness" of production as long as meaning is clear.*
6. **PRINCIPLE OF PICTORIAL CONTEXT:** *An audience responds*

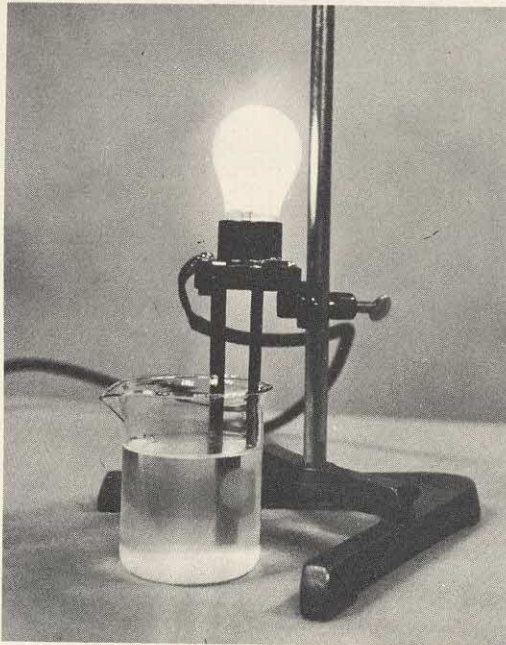
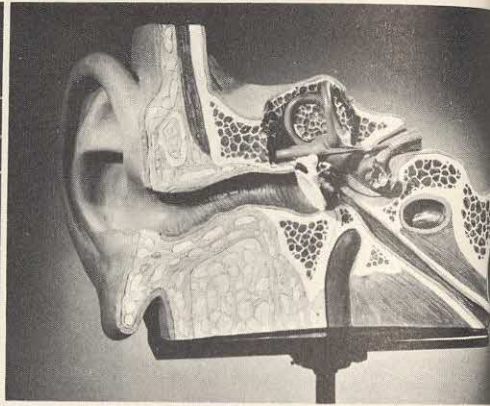
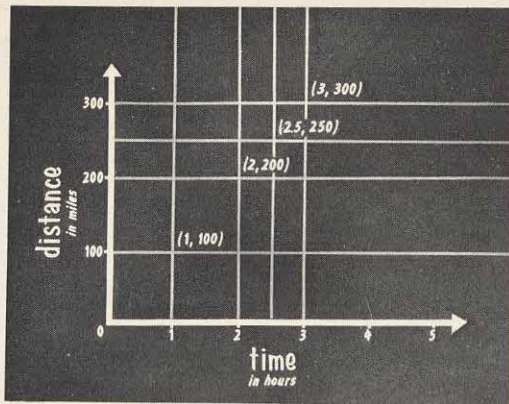


Figure 2-17. These views are from the following motion pictures: *Graphing Linear Equations*, *Ears: Their Structure and Care*, and *Chemical Bond and Atomic Structure*. These scenes show the value of close-up photography in film sequences in providing opportunities for observation of details by an entire class at the same time. (Courtesy Coronet Instructional Films, Chicago, Ill.)

selectively to motion pictures, reacting to those things which it finds familiar and significant in the pictorial context in which the action takes place.

7. **PRINCIPLE OF SUBJECTIVITY:** *Individuals respond to a motion picture most efficiently when the pictorial content is subjective for them.*
8. **PRINCIPLE OF RATE OF DEVELOPMENT:** *Rate of development influences the instructional impact of a motion picture on its audience.*
9. **PRINCIPLE OF INSTRUCTIONAL VARIABLES:** *Established instructional techniques, properly built into the film or applied by the instructor, substantially increase the instructional effectiveness of a film.*
10. **PRINCIPLE OF INSTRUCTOR LEADERSHIP:** *The leadership quali-*

*ties of the instructor affect the efficiency with which his class will learn from the film or filmstrip.*¹

The film medium lends itself to instructional use in both large and small groups, and also for presentations in groups where multi-group activity is being carried on in the same room by using headphone equipment for those viewing the picture. Also, the film medium is, as everybody knows, widely used in television programing. The film in both 8mm and 16mm widths may also serve as the hub of learning activity in another unique way, that is, when motion pictures are produced as a joint endeavor by pupils and teacher as a major class project, or by a selected group of pupils working on a voluntary project basis. To be sure, this unique learner activity demands additional equipment, such as a camera, perhaps with turret lenses, lights, tripod, light meter, film viewer, and splicer unit, together with film supplies and money for processing service.

Teachers who use the film medium frequently need to know the following facts: (a) there are 40 separate frames of still pictures in a foot of 16mm motion picture film; (b) the image on the film is in an emulsion base coated on one side of the film and the emulsion side is the dull side, which is softened by moisture; (c) standard sound speed, or the rate of travel past the projector aperture, is 24 frames per second; (d) the running time of a 400-foot 16mm reel of film is 11 minutes, hence a reel with 800 feet of film requires 22 minutes to run off at standard sound speed; a 1200-foot length of film therefore requires 33 minutes, and so on; (e) standard speed for 16mm silent film (very rare now since even most amateur silent films are shot at 24 frames per second) is 16 frames per second, hence the running time is more than 15 minutes per 400-foot reel; and (f) a number of projectors still have a silent speed switch, and, when this slow speed is accidentally used on a sound film, the sound becomes too low in pitch and too slow, hence making it unintelligible.

The motion picture may be in the form of a complete film production or in a segment, that is, a segment of footage. In fact, the so-called *film clip* has "come into its own" as a visualization technique in television. Also available in increasing quantities is the so-called single-concept film in 8mm size, packaged in its own cartridge, and ready for insertion into its own special projector. Instructors should learn to use films as an integral and systematic part of their teaching designs, for they may be

¹ Charles F. Hoban, Jr., and Edward B. Van Ormer, *Instructional Film Research, 1918-1950 (Rapid Mass Learning)*, pp. 9-2 to 9-8. Sponsored jointly by The Department of the Army and the Navy, December 1951. Distributed by U.S. Department of Commerce, Office of Technical Services, Washington 25, D.C.

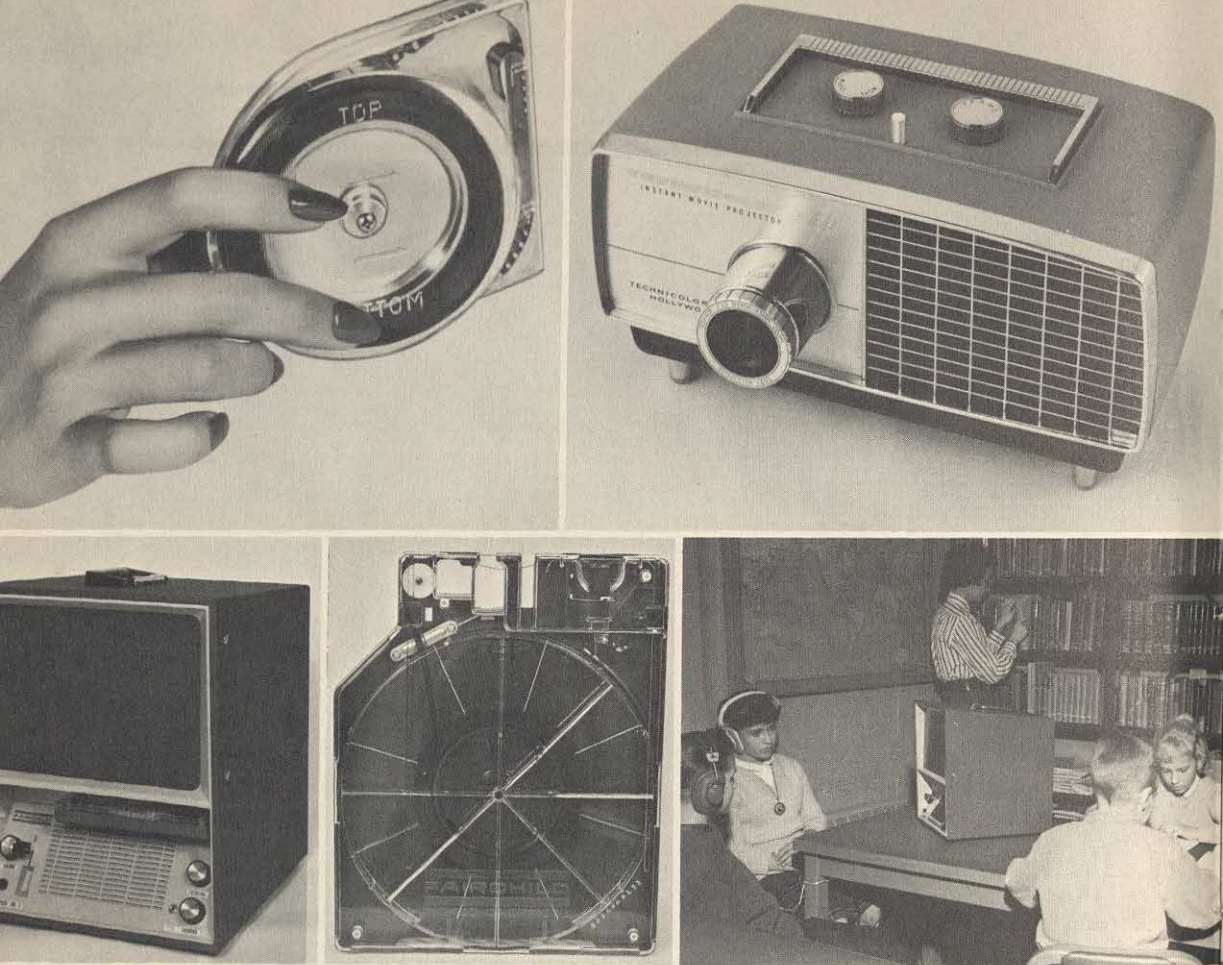


Figure 2-18. There have been some unique developments in the motion picture medium. One of these is the 8mm film cartridge and special projectors to use them for both classroom groups and individuals. Pictures at the top show the silent, single-concept film mounted in a Magi-Cartridge® ready for insertion into the 8mm International Communicator Model of the Technicolor® projector. Pictures at the bottom show the Fairchild Magnetic soundtrack, rear-screen projector, and a close-up view of the special 30-minute 8mm film cartridge. (Courtesy International Communication Foundation, Monterey Park, Calif., for pictures at the top; and courtesy Fairchild Camera and Instrument Corp., Plainview, L.I., N.Y., for pictures at the bottom.)

destined to become the most desirable of all the technological materials to provide rich experiences, vicarious though they may be.

THE PROJECTED STILL PICTURE MEDIUM

The medium of the projected still picture places in the hands of the teacher a wide range of technological developments of major impact.

58 First and most prominent in probable volume of use is the filmstrip, but

the lantern slide had long preceded it, having been invented in 1643 and popularized for school use around 1895. With the popularization of the 35mm camera came the 2-inch by 2-inch color slide, but preceding it had come the use of reflected-light picture projection (by means of the opaque projector), and the use of projected microscope slides and microscopic objects by means of the microprojector. Recent technological developments in diazo-coated film now introduce a source of ready-made and teacher-made transparencies. All of the kinds of materials in this medium lend themselves to prolonged analysis; however, some still-projected images are designed to be flashed into view for short-time intervals by an instrument called the tachistoscope, or, more simply, by a flashmeter (a giant shutter-release mechanism) and a filmstrip or slide projector.

We turn now to a brief description of each of these commonly available technological materials.

Lantern Slides. Most recent developments technologically have made it possible for teachers to make their own slides in three minutes or less, using a Polaroid camera on a copymaker stand complete with lights. One

Figure 2-19. This teacher is using an overhead slide projector with a flashmeter over the lens to control the time that an image appears on the screen. Such a combination of devices is called a tachistoscope. The typists in this class must learn to see whole sentences at once in their copying exercises. Note the special slide, 4 by 7 inches in size, a collection of short-exposure targets, on the projection stage of the projector. The flashmeter may be adjusted to open and close at various speeds. (*Courtesy Keystone View Company, Meadville, Pa.*)

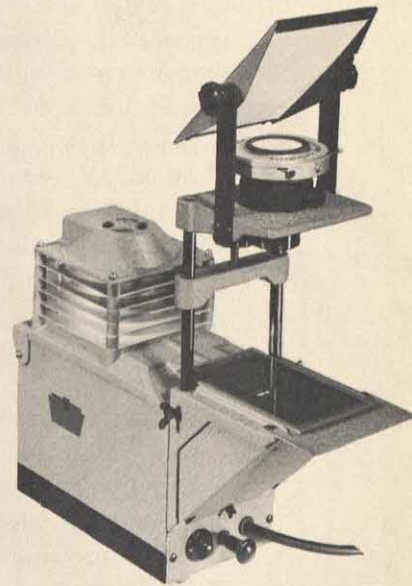




Figure 2-20. This inexpensive device may be mounted on the lens barrel of slide projectors. The so-called target slides, one item on each, are made up as needed. Three exposure speeds are approximated. (Courtesy Audio-Visual Research Company, Chicago, Ill.)

type of film, designated as 46L, is best for general use, including half-tone reproductions. Another type, 146L, is best for line drawings, tabulated data, and graphs. Developing time is two minutes for the former and ten seconds for the latter. Polaroid slides may be made up in two sizes, $3\frac{1}{4}$ -inch by 4-inch and $2\frac{1}{4}$ -inch by $2\frac{1}{4}$ -inch. Teachers in increasing numbers are also making their own 2-inch by 2-inch color slides using single-lens reflex cameras; thus they have a wealth of color illustrations from books and periodicals for classroom use. Detailed procedures for such processes are given in Chapter 6.

In addition to these teacher-made sources there are numerous agencies that distribute commercially prepared slides in $3\frac{1}{4}$ -inch by 4-inch and 2-inch by 2-inch sizes. In general the development of the small-size slide technology depressed the volume of use of the large-size pictorial slide, but companies manufacturing them have expanded their efforts into the production of "target" slides for "short-exposure" processes for diagnostic and remedial work in the 4-inch by 7-inch size. Several companies also manufacture supplies for teacher-prepared $3\frac{1}{4}$ -inch by 4-inch slides. Etched glass and plastic, clear cover glass, masks, binding tape, special crayons for lantern slide work, and lantern slide inks, all of which



Figure 2-21. Note in this picture the various sizes of slides. Most commonly used today are the 2-inch by 2-inch slides in color. Slides in 3 1/4-inch by 4-inch size, especially made by Polaroid Land Camera processes, are becoming increasingly common among teachers in schools and among researchers who present papers to large groups. Details on preparation are in Chapter 6. (Courtesy Polaroid Corporation, Cambridge, Mass.)

may be bought in bulk, facilitate the making of such slides by both teachers and pupils. Step-by-step procedures for making etched-glass slides also appear in Chapter 6.

Filmstrips. Literally thousands of filmstrips, a collection of picture frames on a strip of 35mm film, designed for most subjects and all levels of instruction, are available to teachers. Undoubtedly, more filmstrips are used than any other single kind of projected material. There are more than 300 filmstrip producers in the United States today, among which a score or more are major producers for instruction. The oldest of these is the pioneering Society for Visual Education of Chicago that was organized for service to schools in 1919. Specialized producers like Life Magazine have also made available materials of rich instructional potential. Some of the filmstrips produced today are called sound filmstrips because they are designed to be accompanied by disk and tape-recorded commentary, or by the newer optical track sound, played in a special film-strip projector and sound player unit.

Not all filmstrips with good-sounding titles are of high quality. Quality is not a singular characteristic. It is a composite of a number of elements,

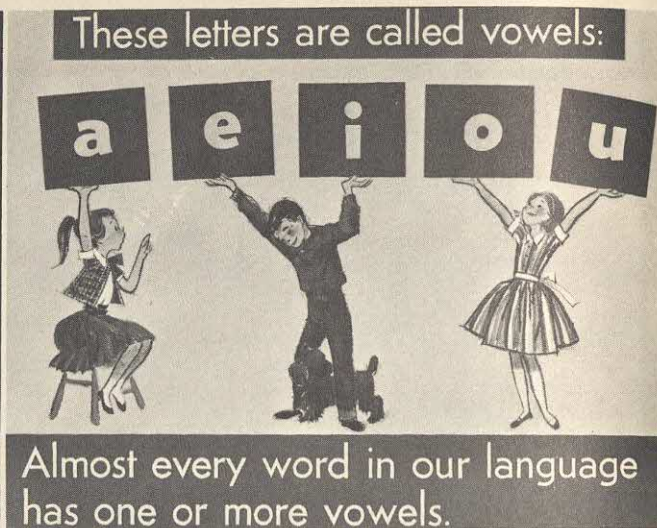


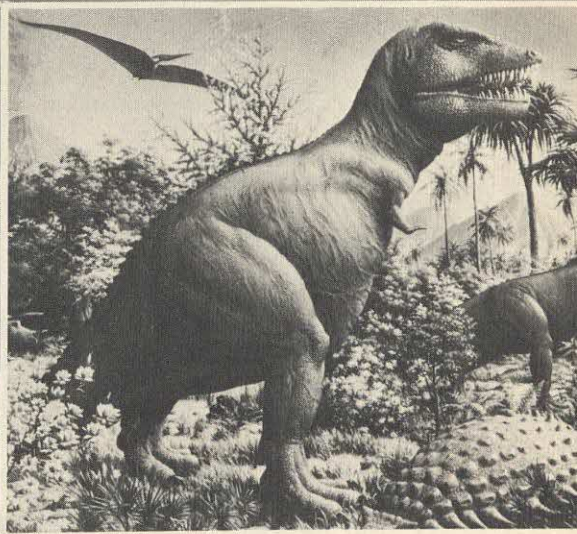
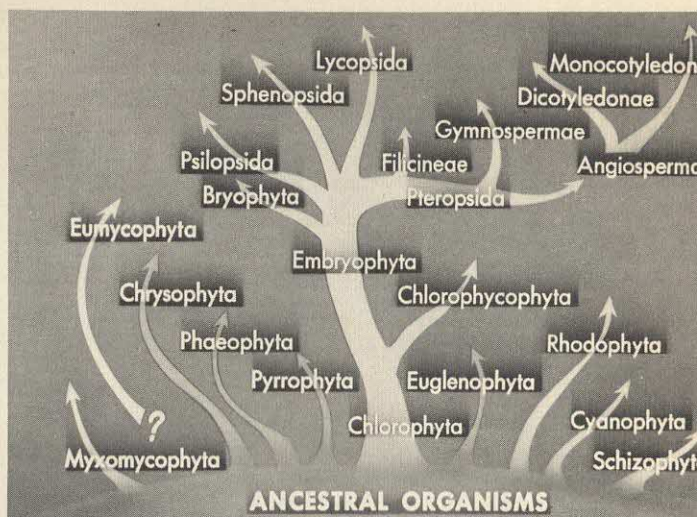
Figure 2-22. These pictures are from the *Basic Primary Phonics* and from the *Basketball* series. Filmstrips are available from scores of producers, some specialized, some comprehensive. Readers should consult available catalogs. Some major producers are listed in the Appendix. (Courtesy Society for Visual Education, Inc., Chicago, Ill.)

and the criteria, both general and specific, which are listed in Chapter 3, should be studied and used to formulate judgments about it. One thing needs to be emphasized again and again, that is, teaching tasks for target groups are highly specific, and it is not likely that a set of pictures and/or drawings can be fitted with complete effectiveness to any given number of school situations. Therefore, instructors have to select first a subject in the light of their objectives and then select frames from within the strip to suit the needs of their pupils. Several operational features are described for such procedures in Chapter 5. All that is said in the basic principles for utilization applies to this medium, and filmstrips may serve the teacher in the ways described in the basic roles identified in Chapter 1.

Filmstrips are also used by other media, for example, certain teaching machines. Indeed, the most expensive electronically controlled machine uses the filmstrip to present the program-learning sequence. An additional example of their use is in "short-exposure" projection units with a "target" on each frame. Filmstrips are shown in use in one of the case studies in Chapter 4 for individualized instruction, and filmstrips possessing the required characteristics could also be used for visualized presentations for large groups as in a team-teaching situation.

Transparencies. Although a number of still-projection materials like the slide and filmstrip are also, strictly speaking, transparencies, this term refers to the large-sized projectuals of the "static" or "dynamic" variety used with the instrument known as an overhead projector. Transparencies

Figure 2-23. The three views shown in this group are from the *Classification of Plants and Prehistoric Life* series. High quality in filmstrips is possible when the original photograph is outstanding. Content in each frame should be significant, hence scrutiny before use is recommended. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)



are usually of the teacher-made variety, or at least made up for the teacher to his specifications. Recently a number of agencies have been and are manufacturing transparencies in a number of subject fields such as science, mathematics, mechanical drawing, and others. The transparency medium has been growing rapidly in popularity, owing in part to successful use by armed services everywhere in their highly effective training programs. Team-teaching activities, as the case studies in Chapter 4 show, make excellent use of this medium for a variety of purposes in large-group presentations.

Photocopying technology has also contributed to the accessibility of transparencies for teachers, produced as they can be in a few minutes of time. With a little more time and a stock of supplies teachers may proceed by simple procedures to visualize some of the most difficult concepts by



Figure 2-24. The overhead transparency process has developed phenomenally in the last decade. A unique feature is the overlay procedure that makes possible a part-by-part build-up of a concept or process. In this picture the last layer of several has been flipped down into position. Note the hinge to the right of the teacher's hand. See details about preparation in Chapter 6. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

making what is called "multiple-overlay" transparencies. This process is explained in detail in Chapter 6, and operational features are discussed in Chapter 5.

Microprojection Material. In science education at elementary and secondary levels it is generally agreed that the microscope is an instrument that facilitates learning through direct observation of material and processes. However, if the teaching focus is on the objective of developing insights, the ability to make accurate observations, and the ability to draw conclusions from facts, the microprojector will serve the teacher as effectively as the microscope and add the additional benefit of facilitat-



Figure 2-25. Teachers make their own materials of diverse nature, depending on their objectives and communication difficulties. This art teacher is using a lightweight Thermo-Fax projector, plus a number of movable pieces of transparent colorful acetate to present information about the theory of balance. Care is needed to prevent obstructing the view of the projected image. (Courtesy Visual Products Group, 3 M Company, St. Paul, Minn.)

Figure 2-26. Pupils may easily construct their answers for class observation, writing on inexpensive acetate sheets as in this case. (Courtesy Visual Products Group, 3 M Company, St. Paul, Minn.)



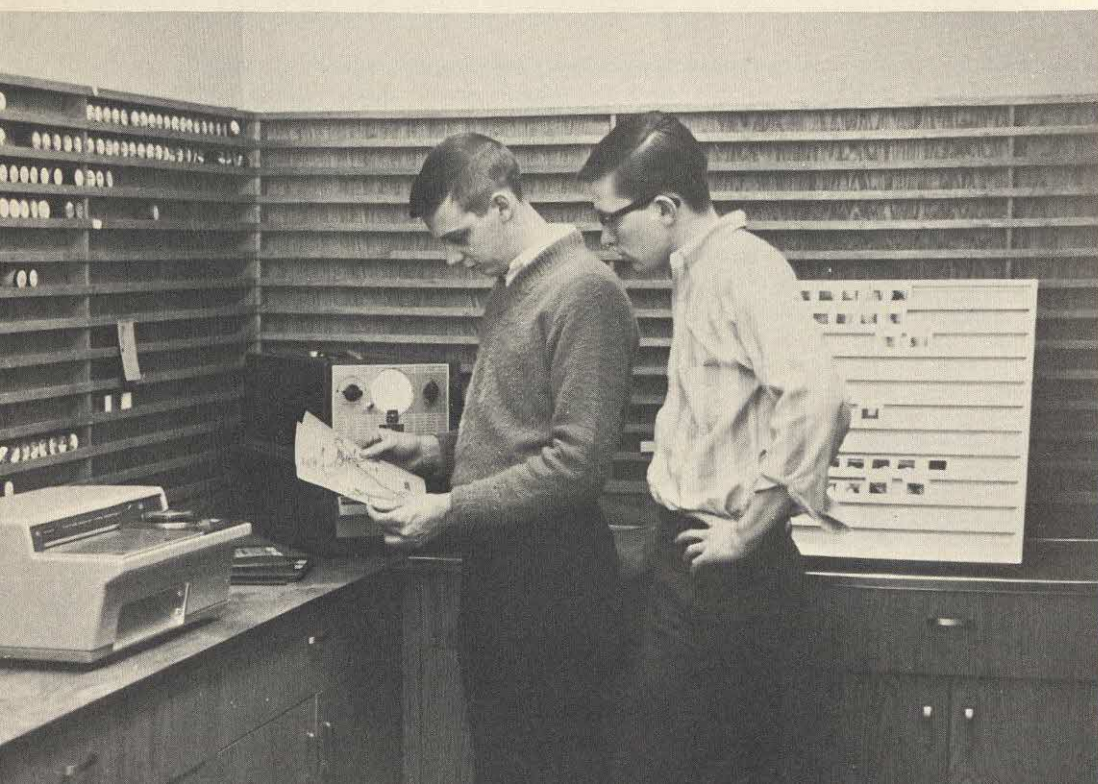
ing a group presentation of the same material that is observed by only one person at his microscope.

However, in biology, for example, the use of the microscope by individuals may add to the learning situation a glamorous impact, a feeling of personal discovery. It is also true that many teachers believe that the ability to operate a microscope is a valid teaching objective even though the biology course is not vocational in nature, that is, vocational in the same sense of a program for *medical technicians*.

Microprojection materials range from inanimate to animate, and live materials may be projected, as, for example, one-celled animals in a hay infusion. Microscope slides are available commercially in wide variety.

To project such materials a number of projectors are sold that range in price from \$85 to \$1500, with light sources ranging from 100-watt lamps to electronically controlled carbon arcs. A number of attachments have also been manufactured for use on the widely available filmstrip and 2-inch by 2-inch projectors, and at least one inexpensive attachment is available for the overhead projector for $3\frac{1}{4}$ -inch by 4-inch slides. Some scientific supply companies still have microphotographs in the form of $3\frac{1}{4}$ -inch by 4-inch size slides for use in the standard lantern slide projector, that is, directly usable without any microprojector attachment. In

Figure 2-27. In this learning resources center a crew of trained students is engaged in preparing projectuals for teachers by means of the dry-process, Thermo-Fax photocopier and the Ozalid wet-process copier. The result is single transparencies of current maps and graphs and/or printed copy. (Courtesy Penfield Central Schools, Penfield, N.Y.)



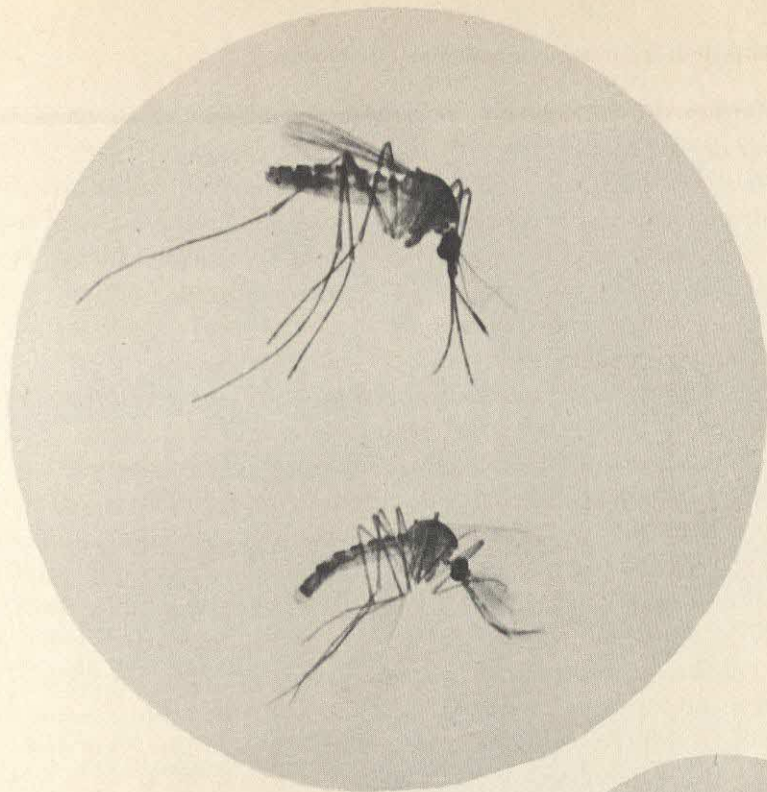
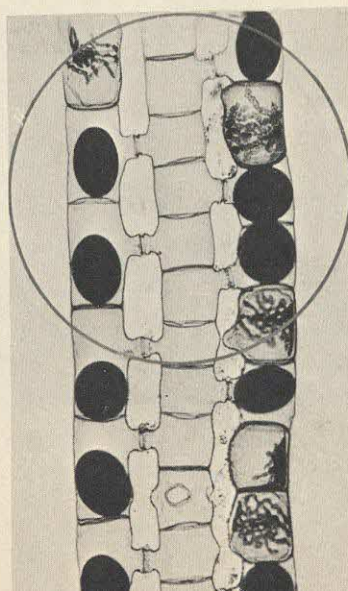
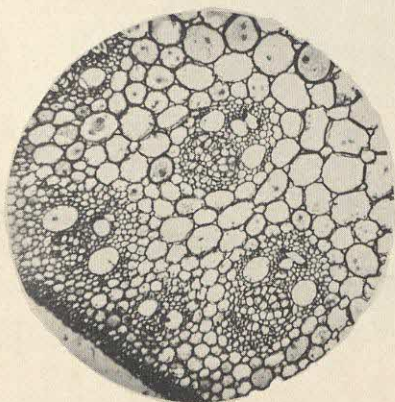


Figure 2-28. These microscope slides indicate that a wide variety of projection material is available commercially. Slides show mosquito, ameba, spirogyra, and corn stem. (Courtesy Central Scientific Company, Chicago, Ill.)



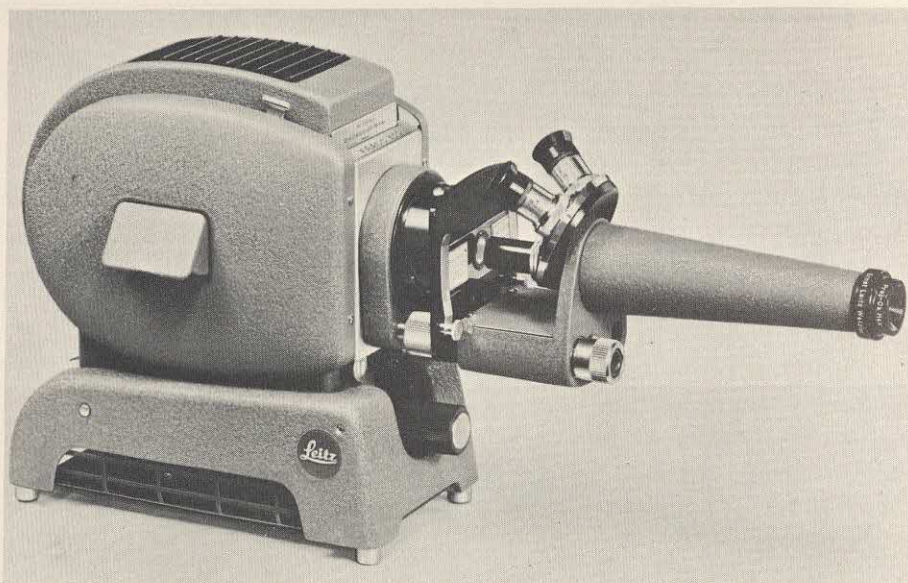


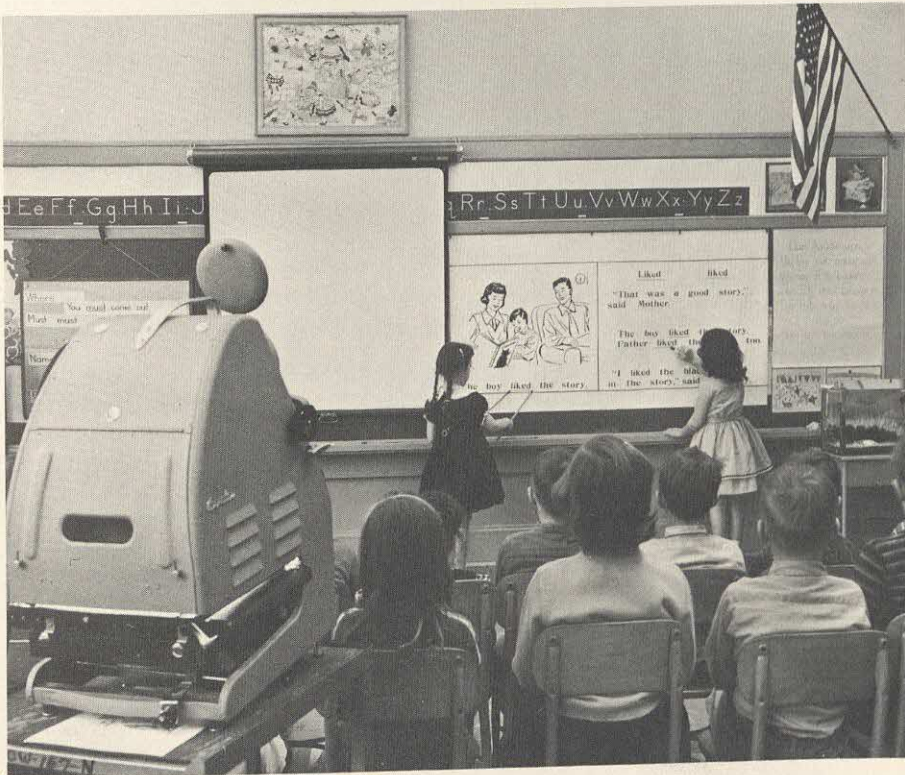
Figure 2-29. Shown here are two microprojectors of considerably different design. The horizontal model shown first is the Prado 500 (*Courtesy E. Leitz, Inc., New York, N.Y.*) and the next is the MI-35081 RCA (*Courtesy Radio Corporation of America, Camden, N.J.*)

this connection the process for preparing Polaroid slides, described in Chapter 6, lends itself conveniently to the job of copying such illustrations as electron-microscope photographs.

Opaque Projection Materials. Vastly different from other instruments, the opaque projector projects an image by reflecting light from the surfaces of the picture or object onto a regular projection screen. The size of usable objects is limited to the space between the top of the lowered projection platen and the body of the projector, and the size of pictures or sheets on which pictorial material is mounted is limited to approximately ten inches by ten inches.

The scope of materials available is practically limitless when teachers have the instrument and a satisfactory room darkening system available. An arrowhead, a fern leaf, a swatch of cloth, a penmanship sample, a

Figure 2-30. In this first-grade situation the opaque projector plays an important role as a display device for formal instruction in reading. Every morning, according to Thelma Love, the teacher, full pages of reading material are projected on the screen. By turning the projector slightly, the image is projected when desired on white wrapping paper taped to the chalkboard. Pupils may thus in turn go to the chalkboard to put marks on the paper. The room, of course, must be suitably darkened to enhance the quality of the projected images. (Courtesy Euclid Board of Education, Euclid, Ohio.)



portion of a pupil's theme, postage stamps, coins, crystals, hand-drawn diagrams, snapshots, flat pictures, postcards, typed tables of data, and textbook illustrations are a few representative items that may be projected.

It can be readily seen that if a small cartoon, picture, or other illustration needs to be enlarged for chalkboard or bulletin-board utilization, it can be projected onto wrapping paper, poster paper, the chalkboard itself, or to the bulletin-board surface, for tracing and processing.

A few operational features for using this unique projection instrument in the classroom are discussed in Chapter 6 under the topic of preparing opaque projector material.

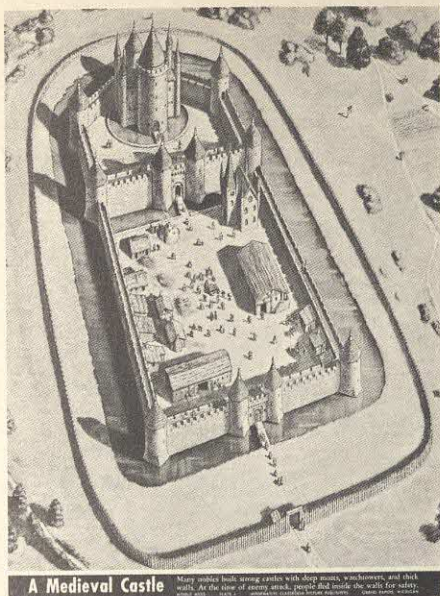
THE NON-PROJECTED STILL PICTURE MEDIUM

The medium of non-projected still pictures possesses a rich potential, but teachers must know how to use it for valid educational objectives at the day-to-day level. Many teachers believe that to decorate a room with pictures is their only responsibility. Consequently, it is not uncommon to see pictures mounted on the walls, the favorite place being between the top of the chalkboard and the ceiling, far above pupil-observation capability except in the most general sense. Good teachers have a vastly more active design for facilitating study of still pictures, and these operational teaching practices are described in considerable detail in Chapter 5.

A number of the leading school technological service centers have recognized the value of wisely selected and effectively mounted study prints by making them available in sets on significant curriculum topics to all teachers. Some of these pictures are laminated in plastic, others are mounted by dry-mount-tissue methods and boxed for safe distribution. Still other study prints are individually packaged with cardboard covers, as, for example, 22-inch by 28-inch art prints.

Vast improvements have been made in arranging and printing textbook illustrations, and these need to be more fully used by teachers. Guidance is the key word to this action. That is, the process of eliciting desired responses from pupils by setting up problems, projects, and/or questions that call for observation, collection of data, and the development of insights.

Excellent units of study pictures are now available in increasing numbers; teachers should locate them and request that school-building and school-system service centers purchase them.



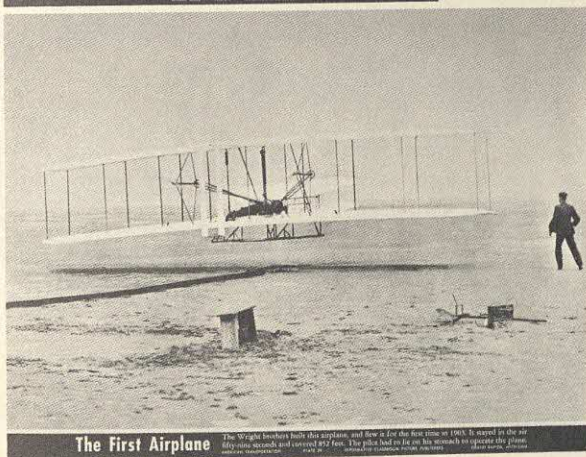
A Medieval Castle

Many castles built strong castles with deep moats, watchtowers, and thick walls. At the time of every attack, people did inside the walls for safety.



A Medieval Street

The streets of a medieval city were narrow, dirty, and crowded. Houses were several stories high and wedged closely together. Shopkeepers displayed their goods on counters that opened onto the streets.



The First Airplane

The Wright brothers built this airplane, and flew it for the first time in 1903. It stayed in the air for 17 seconds and covered 120 feet. The idea led to the use of airplanes to transport people and goods.



A Jet Airliner

Jet airplanes fly from coast to coast in 3½ hours. They travel faster than six hundred miles per hour, and climb to an altitude of many thousand feet.

Figure 2-31. Study prints (sometimes called flat pictures) may consist of photographs of actual objects or processes, or they may consist of drawings, sketches, or diagrams. Drawings may achieve maximum relevancy for teacher purposes, and photographs may be more realistic. Study prints provide opportunity for prolonged individual study. The pictures shown are photographs of pictures selected from two sets titled, *Middle Ages* and *American Transportation*. Picture arrangements as illustrated, which present sharp contrasts and comparisons, are often very stimulating and revealing. Students may be benefited greatly in their concept-building processes by the concrete images presented. An analysis of picture-reading processes is presented in Chapter 5. (Courtesy Informative Classroom Picture Publishers, Grand Rapids, Mich.; H. Robert Armstrong, Photography, Philadelphia; and the Smithsonian Institution, Washington, D.C.)

THE MEDIUM OF AUDIO PROGRAMS

The medium of audio programs prior to 1945 consisted of radio and disk-recorded presentations. With the demise of organized radio network 71



Figure 2-32. This group of German students is listening to recordings by means of headsets plugged into an aggregate box on the table. Work sheets and/or textbook references are often used today to guide student participation. (Courtesy Newcomb Audio Products Company, Hollywood, Calif.)

programing for school use around 1949, and under the influence of the electronic revolution, disk recordings, then also called radio transcriptions, rose to new popularity. Music, literature, science, social studies, and language productions appeared in considerable quantities, and the instruments needed to play them increased in technical quality and decreased in price. Every school today still needs record players by the dozen.

Fortunate are those teachers who are teaching in areas served by locally owned and operated school radio stations, for radio programing offers many significant opportunities for instruction. It was once believed that school radio stations would be widespread in number, but to date this expected movement has not materialized. Yet, it is true that despite the present expansion of television for schools, school radio broadcasting services are still prospering in a number of cities both large and small. We may mention as examples such cities as St. Louis (KSLH), Cleveland

(WBOE), Atlanta (WABE), Portland (KBPS), Chicago (WBEZ), New York (WNYE), and Huntington, Indiana (WVSH). Scores of examples are to be found principally in the states of Indiana, Ohio, Missouri, Wisconsin, Minnesota, New York, Illinois, and Michigan. Radio at the time of its invention constituted the fastest means of sound communication known. Inherently, it has the capability of reaching audiences of unlimited size simultaneously throughout the world. Television, of course, added the video component to this rapid communication system.

But it is magnetic tape, common commodity of the space age, that now dominates the audio program medium for schools, and it is impressive that the tape instrument appeared for the first time as recently as the mid 1940s. Today, tape programing includes not only the usual types of content presented earlier on disk recordings and radio, but also a unique kind of instructional content of a highly specific nature designed to elicit responses from pupils in a sequential pattern. Such programing

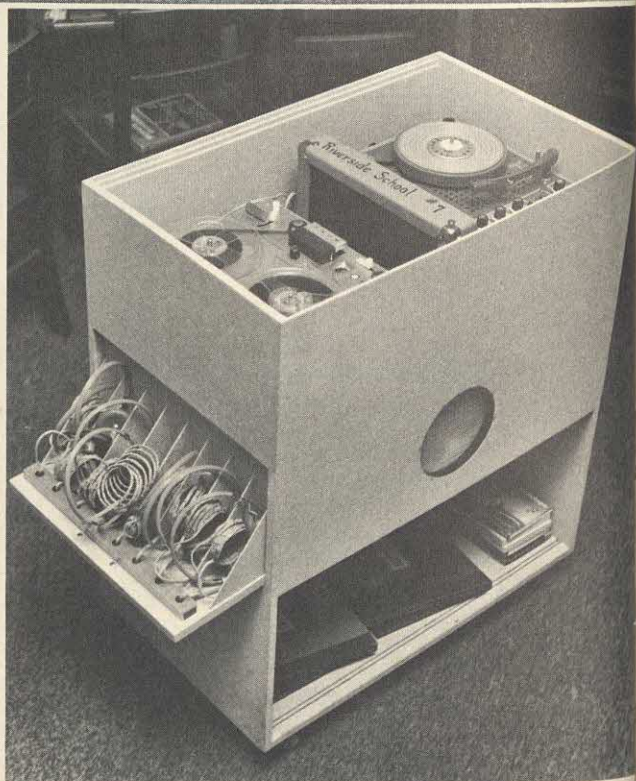


Figure 2-33. These school-system facilities are operated by students and teachers at the Huntington High School. Unusual opportunities to move instructional information to various combinations of pupils are afforded by school-radio broadcast facilities. What benefits are likely to accrue to students who plan, rehearse, and produce radio broadcasts? What lifelike activities do students in these situations practice? (Courtesy Board of Education, Huntington, Ind.)





Figure 2-34. These elementary school students have been grouped for private audio tutoring in a multi-activity class situation. This classroom audio-center device was designed and is distributed to local schools by the school-system instructional materials center. The unit contains a tape recorder, a record player, and a set of headphones connected to a tray that tips into the body of the cabinet. (Courtesy Board of Education, Greenwich, Conn.)



lent itself admirably to both large- and small-group and individual use, and in actual operation served the language field first in a phenomenal national development.

Team-teaching processes also found excellent uses for both tape and disk productions, most of which were prepared on the spot by the teachers involved, and taped content is available for many subject-matter fields from both nation-wide and state-wide tape duplicating centers. Thus the tape recorder and its private extension pipeline to the pupil, the headset, is a unique element in the medium of audio presentations. In this particular discussion of media, magnetic tape and the instruments for its use like the recorder, player, and the headset, as an extension loudspeaker, probably deserve to have been included in the subsequent section on *new media*. However it is also true that it is the electronic learning laboratory, or the listening-response, application of the audio presentation technique that is new in the late 1950s, and hence, as unique as it is, magnetic tape procedures are discussed as a part of the broader audio medium.

Teachers who use the audio program medium must plan creatively to fit such presentations into their instructional designs, again based on their valid objectives. Precise timing and the creative ways of relating presentations to pupil activity, both before, during, and after their use,

Figure 2-35. The teacher aide as a part of a teaching team is managing the mechanical and clerical operations in providing this group of students with special taped instruction. Are pupils being asked to make overt responses? The social studies teacher is working with another segment of the total group. Note the transparency projection situation. Is the permanent projection screen suspended away from the wall? By what method is the screen tilted? Other references are made to overhead transparency projection in Chapter 5. (Courtesy Board of Education, Norwalk, Conn.)





Figure 2-36. This class group is using the Howe Audio Carrel-Desk. This furniture may be used in a conventional environment (left) and then, as shown at right, converted as needed into an electronic learning laboratory situation. (Courtesy Howe Folding Furniture, Inc., New York, N.Y.)

are crucial matters. Teachers should seek guidance in their planning from the basic principles in Chapter 3, from the statement of basic roles in Chapter 1, and they should also consult, more particularly in the case of tape programs, the description of specific teaching practices and mechanical features of operation in Chapters 5 and 7, respectively.

The instructional media discussed in the preceding paragraphs are indeed commonly known today, although, in many schools, the needed



Figure 2-37. Taped audio programs are sometimes set up for use by individual students who operate their own tape-recorder units quite apart from a group situation. In these courses, if other students are present, headphones must be plugged into the speaker output jack to avoid distracting them. Booths will also be needed if several students are recording at one time. (Courtesy 3 M Company, St. Paul, Minn.)

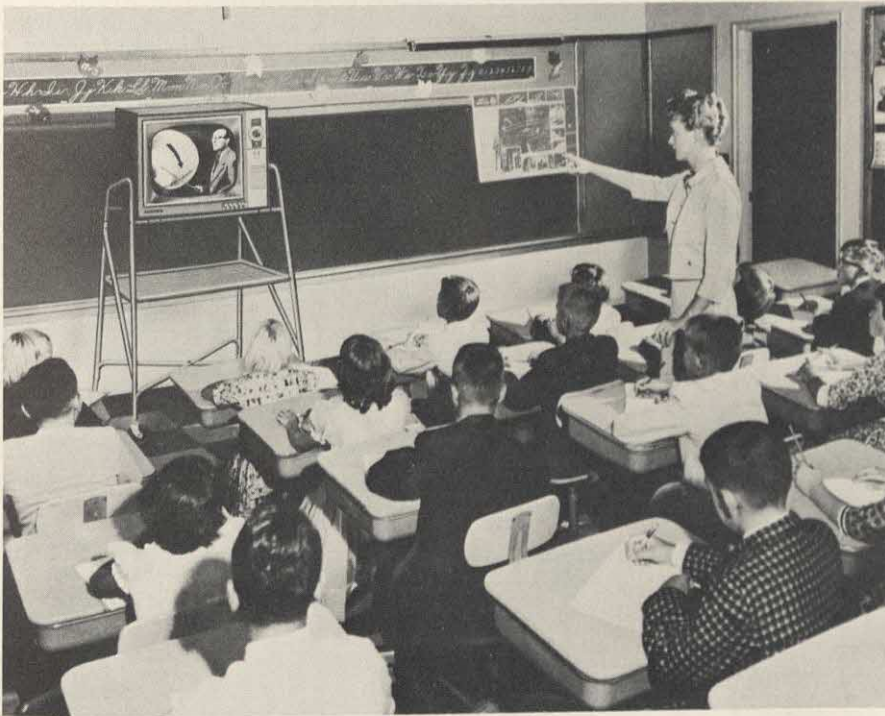
equipment, classroom light-control systems, and service personnel are not yet available in such quantity that teachers may use them fully without inconvenience. But, even as the lack of full development in some quarters is deplored, still newer technological media have been developed and have been introduced. It is to the media of more recent development that we now turn.

Media of More Recent Development

THE MEDIUM OF TELEVISION

In Chapter 5 we identify special teaching practices likely to be used because of the nature and source of the received program content. In this section, however, we turn to a general discussion of television as an instructional medium. Television in the sense of studio, transmitter, and

Figure 2-38. This conventional size classroom group may be one of many smaller groups combined through simultaneous viewing of television programs into a large audience. All media may be combined electronically in a television program, in the fastest and most convenient way known, to present a precisely timed complex of stimuli. Studio and classroom teacher relationships are listed in detail in Chapter 5. (*Courtesy Radio Corporation of America, Camden, N.J.*)



receiver is, of course, a transmission and display system, but in this particular topic we refer to television as the program itself. As such, television is a composite of verbal and visual presentations. In fact all of the technological instructional media may, through the medium of television (combined and controlled electronically), be uniquely worked into a unified presentation.

This electronic combination of media into a single display system is one of three unique characteristics of the television medium. Two additional characteristics are as follows: (1) it possesses the capacity to reach an audience of unlimited size, simultaneously for all viewers, and (2) it possesses the capacity to transmit program content immediately from the point of occurrence to the point of reception.

Television programs using film clips, slides, models, and illustrated lectures are also at times recorded on 16mm film stock and then projected in classrooms much as a motion picture would be used. They are, of course, also recorded on video tape and then telecast again as needed.

The medium of the television program may be employed in vastly different ways, as in direct teaching with impact on large groups, or widely separated small groups; or it may be employed as a separate program trans-

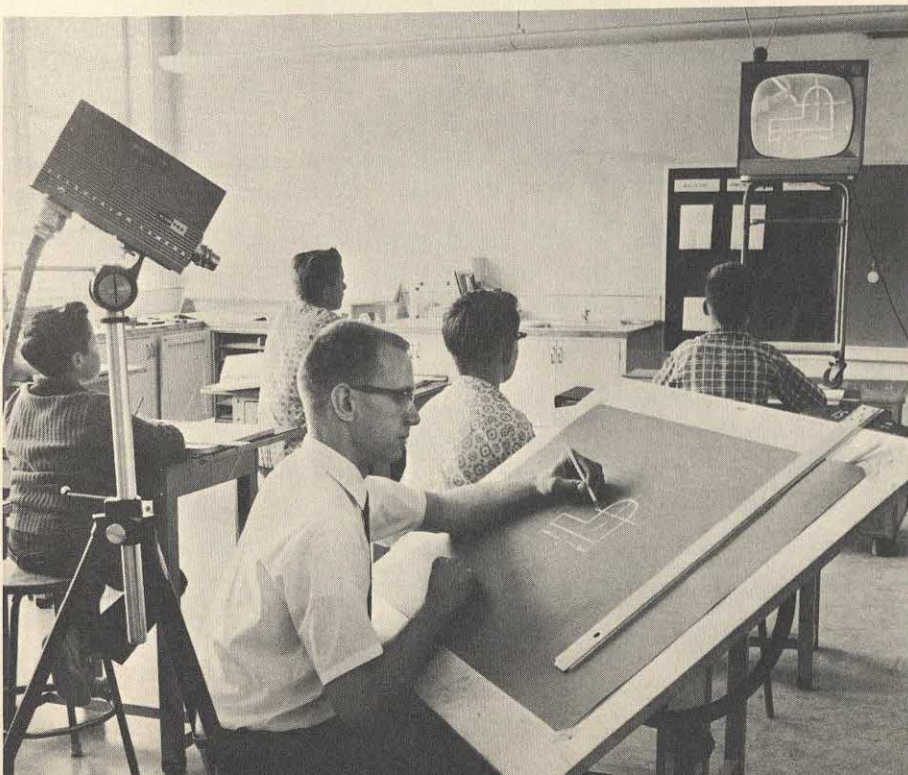
Figure 2-39. This high school typing class has a close-up view of their teacher's hands. This teacher is actually being telecast live to other classrooms as well by the school's closed-circuit system. This program of instruction is originating in this room. It is then carried to a central distributing facility and routed to any combination of receiving classrooms. Note the teacher's microphone, the television monitor at her right, the fixed Vidicon camera, and both receivers for optimum viewing by students. (Courtesy Board of Education, Norwalk, Conn.)



mitted into a classroom where a teacher tunes it in at the scheduled time and uses it in his own unique way to achieve valid objectives. The medium therefore has to be treated by the teacher in the light of local physical arrangements of pupils and classes, and also in the light of organization of the teaching staffs and curriculum content. Certainly a television program received into a classroom environment on schedule needs the creative instructional handling that any other technological medium would need, as, for example, the application of the five basic principles in Chapter 3. On the other hand, if the television program is beamed to a target audience of 500 it may function within an instructional design that makes the presentation self-sufficient, except for supervision by a professional or non-professional managerial force if viewing is done in school during the school schedule. The television teacher who combines other media for a large-group, self-sufficient program must himself be responsible for the application of the five principles to create a design that will elicit the desired responses, thus achieving valid educational objectives.

Programs may in one sense originate completely under the teacher's jurisdiction, as in the case of the electronic enlargement of a demonstration in a biology classroom. Large groups may also be instructed by programed learning sequences presented and controlled by television

Figure 2-40. Here the teacher's own work is being displayed for class observation by a process called electronic enlargement. It is actually a special classroom display system giving all students an over-the-shoulder view of an object, picture, or diagram. (Courtesy La Mesa Spring Valley School District, La Mesa, Calif.)



technology, again with varying degrees of control by large- and small-group supervisory personnel.

Teachers who can utilize television programs according to creative designs may then adapt themselves to any phase of the medium's employment, namely, as a second-level teacher, or as the first-level television teacher in the studio. Programs demanding teaching at both levels are increasing phenomenally in quantity and quality.

Local resources and equipment will determine the degree to which the value of such television procedures are realized; however, the trend toward such processes in teaching is quite obvious. Now the technological climate is favorable even if financial support is weak. But still another teaching medium, namely, the so-called teaching machine, looms large on the educational horizon.

THE MEDIUM OF TEACHING MACHINES

The term *teaching machines* should not be confused with the projectors, tape recorders, and record players previously discussed. In defining the basic difference, A. A. Lumsdaine² pointed out, "All of the devices that have been called teaching machines . . . present the individual student with programs of questions and answers, problems to be solved, or exercises to be performed. In addition, however, they always provide some type of feedback or correction to the student, so that he is immediately informed of his progress at each step, and is given a basis for correcting his errors." B. F. Skinner stated in his article in the *Scientific American* that:

The purpose of a teaching machine . . . is to teach rapidly, thoroughly and expeditiously a large part of what we now teach slowly, incompletely and with waste effort on the part of both student and teacher. Some of the machines also hold the promise of teaching behavior of a kind and subtlety that until now has seemed beyond the reach of explicit teaching methods.³

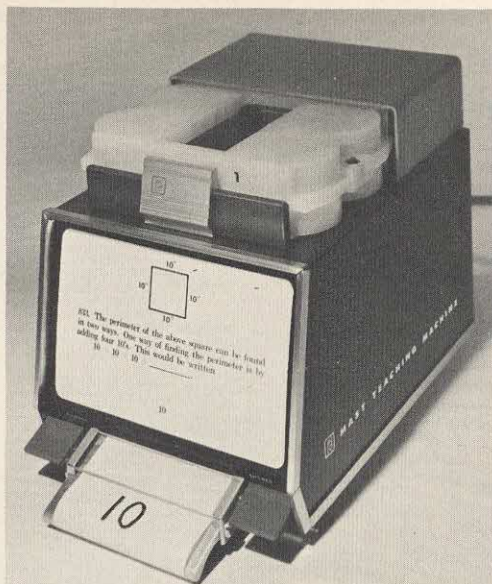
This assertion seemed like a wild claim to experienced teachers who know so well how arduous the job of high-level teaching can be and generally is. But Professor Skinner pointed out how teaching machines could do this job when he said:

Obviously the machine itself does not teach. It simply brings the student into contact with the person who composed the material it presents. It is a labor-saving device because it can bring one programmer into contact with an

² A. A. Lumsdaine, "Teaching Machines and Self-Instructional Materials," *Audiovisual Communication Review*, 7, No. 3 (Summer 1959), p. 164.

³ B. F. Skinner, "Teaching Machines," *Scientific American*, 205, No. 5 (November 1961), pp. 91-102.

Figure 2-41. This Model 1700 Mast teaching machine, presented earlier in Figure 1-15, is shown again here to facilitate comparison with other illustrations. Note the filmstrip magazine at the top of the machine. The programed learning sequence is presented by means of this filmstrip. (Courtesy Keystone View Company, Meadville, Pa.)



indefinite number of students. This may suggest mass production, but the effect on each student is surprisingly like that of a private tutor . . . the machine insists that a given point be thoroughly understood, either frame by frame or set by set before the student moves on.⁴

It is therefore clear that the programed learning sequence is the heart of the teaching machine process. But assuming the presence of the program there is also the problem of arranging for the student to make contact with the material in a definite order of response; therefore each student must be controlled. This so-called *control* is the function of the hardware in a teaching machine, and in its absence, as in a programed textbook, control must be exercised by a unique arrangement of the content.

Machines like these have long been used in research projects, and recently have become increasingly popular in the classrooms of our schools and the homes of our pupils. Today, some models no bigger than a typewriter and others fully electronic, costing \$5,000, are on the market and presently in practical use. As was just pointed out, however, a programed textbook is also a teaching machine without the so-called "hardware," and these are becoming more widely available today, being published by both specialized and regular textbook companies.

In the mid 1920s, Sidney L. Pressey and his students at Ohio State University devised punchboard question and answer devices using multiple-choice arrangements. Students punched an answer to a question, and, if the student's response were correct, the pencil point would sink through an enlarged, paper-covered hole far enough to mark a scoring

⁴ *Ibid.*, p. 97.



Figure 2-42. This is the MTA 100 electrically powered teaching machine. Answers are constructed at the right in responding to the stimulus frames at the left. The student's answer is advanced to a position under the glass plate, at which time the correct answer is revealed for comparison. (Courtesy Modern Teaching Associates, Milwaukee, Wis.)

Figure 2-43. This Konzept-O-Graph teaching machine operates by turning the knob manually. Responses are constructed on the paper strip in the answer unit. The program unit is at the left. (Courtesy Graflex, Inc., Rochester, N.Y.)



sheet. If wrong, the pencil point would be stopped, thus indicating that the student should engage in further deliberation and additional responding. Professor Pressey produced a number of additional key-punching machines but all of them emphasized the multiple-choice pattern of responding to which Professor Skinner objected several decades later, instead emphasizing and developing a student-composed or constructed response procedure. He said:

Except in some kinds of stimulus learning, the student should compose his response, rather than select it from a set of alternatives, as he would in a multiple-choice scheme. One reason for this is that we want him to recall rather than merely recognize—to make a response as well as see that it is right. . . . The machine therefore must have a high capacity and must be designed so that the student has to take each step and take it in the prescribed order.⁵

Because of the procedure of pupils working by themselves on programmed sequences that were under the control mechanisms of hardware-type machines, the glamour-filled name of *automation* became attached to this process of teaching. Some referred to this type of teaching as *automated instruction*, or, more simply, *self-instruction*.

Automation and Self-Instruction. Nobody is suggesting by such words that a pupil will be *educated* by a battery of machines. They do imply, however, that by means of the machines, which contain creatively programmed learning exercises that demand reading, study, verbal and numerical, diagrammatic, and both objective and subjective judgments, students will be required to do a considerably greater amount of independent work or, as it is called, self-teaching.

As teachers use this medium in their classrooms, they will conceivably work out learning sequences in great detail, or purchase them ready-made. After proper introductory work, problem definition, and visualized presentations, they will arrange for effective contact with them by their students. The crucial aspect of such processes is the creative organizational and learning analysis work to be done by the teacher. Also there can be little doubt that as classes come together for certain phases of automated large-group or conventional size group instruction, the commonly known instructional media (films, transparencies, etc.) will be more important than ever. Getting students ready for automatic machine activity or following it up with creative productivity and laboratory work, together with the selection of programs or the actual programming of learning sequences, will be basic teaching tasks.

While self-instruction as a formalized process is based on an entirely new concept, good teachers have probably always used certain aspects of

⁵ *Ibid.*, p. 95.

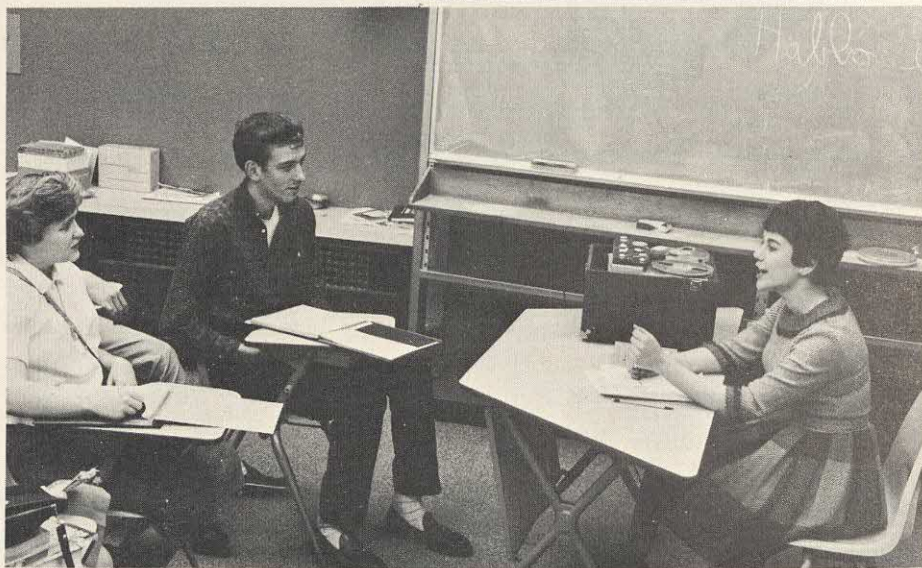
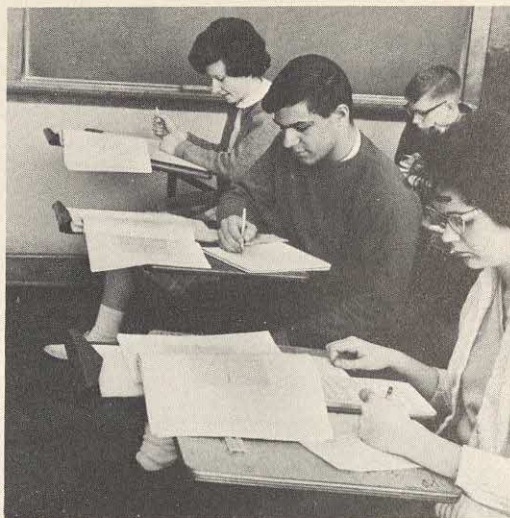
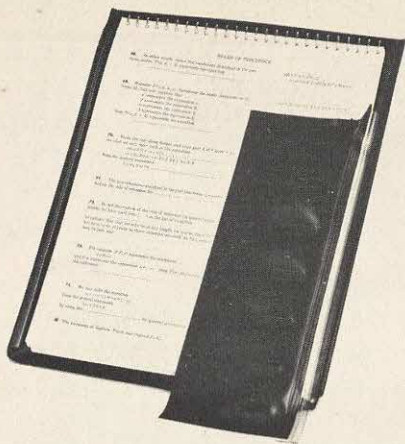
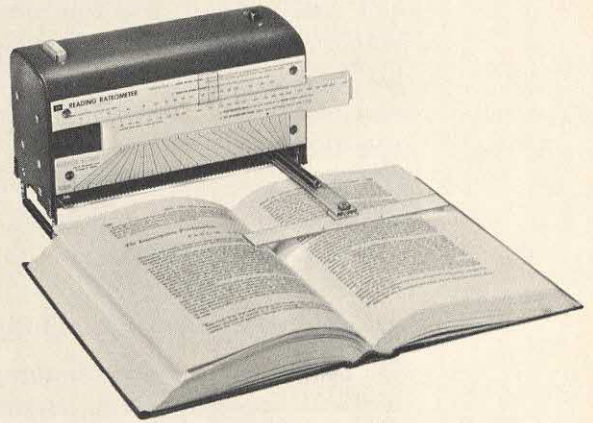
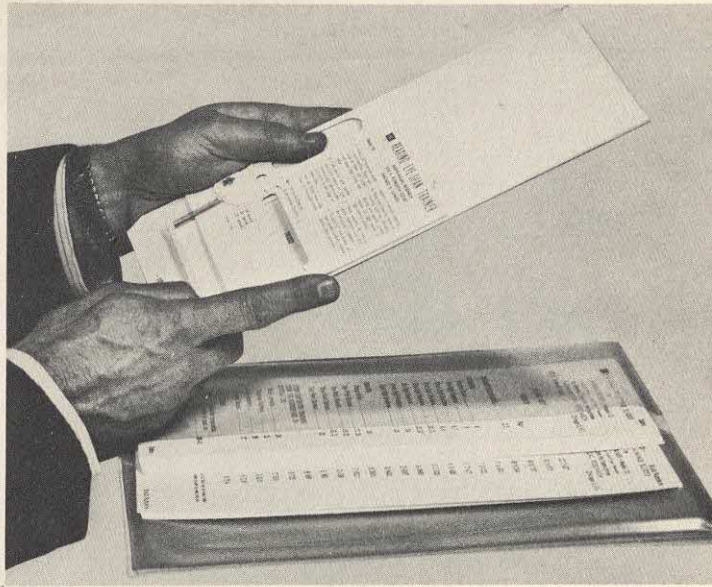


Figure 2-44. Shown in these pictures are Temac teaching machines without the hardware of the other models illustrated. In these cases answers to the program frames are uncovered by moving the plastic slide. Answers are written on the blanks or on separate answer sheets. Separate supplementary exercise pads are sometimes used, and also, for some programs, especially for language, audio components are supplied by means of accompanying tapes. (Courtesy *Encyclopaedia Britannica Press, Chicago, Ill.*)

the process in a variety of ways. For example, teachers in the past have prepared special how-to-do-it guide sheets for students to work on by themselves, guide sheets to accompany textbook assignments, or visualized presentations that called for sequential responses. The fact remains that the specific programming techniques as they are being developed today, for use with or without electronic-mechanical control mechanisms, are new in both concept and format. Learning is of course an intensely personal mat-

Figure 2-45. Devices such as shown in this group of pictures are also self-instructional in nature. The first shown is the Reading Eye-Span Trainer, an inexpensive short-exposure device. The student sets this simple machine, then triggers it, exposing a number. He knows by checking if he has responded correctly. The second device is the Reading Rateometer, which encourages the reader to change his reading rate to meet a given standard. The student knows at once when he fails to meet the established standard. (Courtesy Audio-Visual Research Company, Chicago, Ill.)



ter, although it is organized formally and implemented in large- and small-group situations even by automated processes. Operational features of self-instruction processes will be discussed in Chapter 5, and it is suggested that the details in Case Study Number 6 in Chapter 4 be consulted as a source of additional illustrations.

THE MEDIUM OF INSTRUCTIONAL KITS

With increasing frequency kits or packages of material on diverse topics, ranging from *Adventures With Sound* to *Weather Forecasting*, are appearing. Some of these are mass produced by audiovisual centers and distributed to teachers.

An increasing number of kits are available from commercial sources. 85



Figure 2-46. This device is an individual tachistoscope. See also Figures 1-25, 2-19, and 2-20. This model is called the Electro-Tach. (Courtesy Lafayette Instrument Company, Lafayette, Ind.)

Such kits usually contain a variety of systematically related materials, including motion pictures, filmstrips, magnetic tape, objects, models, disk recordings, student leaflets, programed learning sequences, and/or workbooks, and, in the science kits, apparatus assemblies as well. Another item that will probably appear in the kits soon is the so-called single-concept film, that is, a motion picture segment or film clip of a few minutes duration to supply vital continuity in action and sound, in either or both 8mm and 16mm film widths.

Seely and White of the Los Angeles City Schools Division of Audiovisual Education said the following about instructional kits:

The enthusiastic acceptance of this type of audiovisual resource in Los Angeles can be attributed to several advantages. A thoughtfully prepared kit offers a variety of useful materials to strengthen and supplement a specific area of study; it is a package of related materials organized to simplify procurement; it provides sequential materials geared directly to curricular need; it offers a collection of ready made lessons for inexperienced teachers and flexible resource materials for experienced inventive teachers.⁶

Instructional kits are designed along lines of the multi-media approach. An effectively designed and prepared instructional kit also exemplifies the *systems idea* for teaching with audiovisual media. Under this plan a variety of media (both verbal and non-verbal), teacher action, and specific plans for presenting and using information are an integrated whole that functions as a complete system of classroom operations to

⁶ Patsy Seely and Gene White, "The Audiovisual Kit," *Audiovisual Instruction*, 6, No. 9 (November 1961), p. 440.



Figure 2-47. This instructional kit on Mexico contains a number of instructional media, filmstrips, phono disks, study prints, objects, models, and artifacts. When teachers use this kit together with appropriate printed resources, they are using what is called a *teaching system*. The kit shown provides materials for the teacher to display. If greater freedom for the teacher and pupil is sought, then kits will have to be prepared in quantity, one for each pupil. (Courtesy International Communications Foundation, Monterey Park, Calif.)

achieve stated educational objectives. The reader should study some of the case studies in Chapter 4 with the multi-media and systems approach ideas in mind.

We assert that it is the teacher's professional responsibility to design his plans (not necessarily written out in detailed format) for using audio-visual media in the classroom. This process involves creative decisions that in some instances may require prolonged effort, and in others just a few seconds of deliberation. In fact, this process may involve making decisions on the spot during use in front of the class. This creative process of design for action should be applied to all audiovisual media, and this is precisely what we propose in Chapter 3, titled *Creative Design Through Basic Principles*.

Problem-Solving Activities

1. Jot down a few of the specific instructional media you have already had experience with in your college classes.
2. State as clearly as you can in summary form several vastly different ways your teachers in the past have had you use your textbooks.



3. What kinds of problems would you assign to or develop with your future pupils that would demand field study of *real things*? Be imaginative. Seek lifelike activities. Need students always do this work in an organized field trip as a class? (Check the criteria in Problem 16, end of Chapter 3 for some hints.)
4. Make a list of the media described in this chapter, then regroup them in abbreviated form under the following new headings.
 - (a) The media that are not dependent for their use upon hardware or instruments.
 - (b) The media that pupils themselves may produce as a significant learning activity. (See Role 5 in Chapter 1.)
 - (c) The media that consist of a number of different kinds of material within the group.
 - (d) The media I should be most familiar with because of my particular teaching field.
5. What are some of the basic characteristics of an instructional kit? How should the various packaged materials be unified? How could such packages be used for example to teach an ability? If a kit were complete with textbooks and tape or teaching machines what would the role of the teacher be? Can abilities be taught without opportunities to practice? If not, how can practice sessions or applications be provided? Is the instructional kit a predetermined combination and systematization of a number of media for optimum use in achieving identified objectives?
6. Look through your current subject-matter textbooks and identify by a specific title or heading graphic content for slides, and transparencies that you yourself would like to copy or produce:
 - (a) Five Polaroid slides (3¼-inch by 4-inch).
 - (b) Five 2-inch by 2-inch color slides.
 - (c) Five transparencies with an 8-inch by 10-inch projection area.
7. Look in current filmstrip and motion picture catalogs on file in your school's resource center or media laboratory and identify suitable titles, for any future class you name, as follows:
 - (a) Ten filmstrips.
 - (b) Ten motion pictures.
8. Find a *Tapes for Teaching* catalog for your state or university and identify at least ten titles for your future classes. Now list by topic a set of five tapes that you would like to make for your own classes, with at least one of the tapes being of the direct teaching type, that is, using the teacher's own voice and a work sheet for guiding pupil responses.
9. What is meant or implied by a self-sufficient television program? If you were in your future classroom receiving such a program, what would your role be? Does the educational objective being accomplished by the television program have anything to do with your role? (Chapter 5 contains a treatment of operational features for more complete thinking on this subject, and Chapter 4 includes a detailed case study.)
10. Must the medium of teaching machines necessarily employ electro-mechanical hardware? Is a programmed textbook a teaching machine? In the absence of hardware how is pupil control achieved?

11. Make a list of *real things* that you could bring into your future classes in your teaching field for observation. How would you provide for intimate contact with them? How would you direct pupil observation of them? How would your teaching purposes influence the nature of this activity?
12. How can teachers use all kinds of audiovisual materials to stimulate extended activity?
13. Can a motion picture distort the truth? How? What might a producer have to do with this distortion?
14. Is it possible for a film to be recognized as being in good taste for one group and not for another? Can you give an example?
15. Under what condition is it more of a professional hazard than usual to show an unpreviewed film? If you decide to show an unpreviewed film should you tell a group that you have not examined its content? Is it wise to deceive a class group?
16. By using the form supplied you by your instructor, or the lists of selection criteria in Chapter 3, evaluate any film of your choice.
17. Study several unusually good motion picture subjects and identify the motion picture production treatments that were employed by the producer.
18. Teachers who have accurate knowledge about film material can make good decisions quickly. Can you answer these questions? (a) How do you identify the emulsion side of a film? (b) How many frames are there in a foot of film? (c) What is standard sound speed for 16mm films? (d) What is standard silent speed for 16mm films? (e) What is the running time of a 400-foot, 16mm sound film? A 1600-foot sound film? A 400-foot, 16mm silent film? (f) What effect does running a sound film at silent speed have upon the intelligibility of the sound?
19. What new audio materials grew out of the demise of educational radio efforts by the networks? How do such materials overcome the disadvantages of direct radio broadcasts to the classroom?
20. What precautions must be observed when using diagrams? What must the instructor be sure of before he elects to use a diagram whether on a chalkboard or in a slide?
21. Should youngsters be taught to develop their own skill in expressing themselves by diagrams? What are some suggested activities leading to such skill other than reports in notebooks and drawings on the chalkboard?
22. Identify some unique contributions that television can make to teaching. Identify the basic role stated in Chapter 1 that television can play in helping teachers?

Available Technological Materials for Class Use

Charts for Creative Learning. 16mm motion picture. Bailey Films. Color. 10 min. (Use to illustrate the medium of graphic symbols.)

Effectiveness of Audio-Visual Methods. Filmstrip, 45 frames, color. Basic skill

films. (Use to summarize some basic research findings as a basis for teacher decisions.)

Globes: Their Function in the Classroom. 16mm motion picture. Bailey Films. Color. 14 min. (Use to develop insight into use of graphic symbol medium.)

Handmade Materials for Projection. 16mm motion picture. Indiana University. B & W. 20 min. (Use to develop insight into the still picture medium.)

Making Learning More Meaningful. 16mm motion picture. McGraw-Hill. B & W. 12 min. (To show youngsters at work in a model store and post office planned and set up as pupil problems.)

Mystery of Time. 16mm motion picture. Moody Institute of Science. B & W and color. 40 min. (Use portions to show slow and fast motion techniques.)

Photographic Slides for Instruction. 16mm motion picture. Indiana University. B & W. 10 min. (Use to develop insight into the still-picture teaching medium.)

Relief Models. 16mm motion picture. David Lipscomb College, Memphis. Color. 10 min. (Use to explore the graphic-symbol medium and to identify characteristic teaching practices.)

Second Classroom. 16 mm motion picture. NEA (DAVI). B & W. 28 min. (Use to explore television as a teaching medium.)

Selecting and Using Ready-made Materials. 16mm motion picture. McGraw-Hill. B & W or color. 17 min. (Use film as a basis for identifying roles played by materials in helping the teacher.)

Study Pictures and Learning. Filmstrip, 58 frames, color. The Ohio State University, Bureau of Research and Service. (Use to identify the characteristics of the medium, to point out its advantages and limitations.)

Tachistoscopic Teaching Technique. Filmstrip, 51 frames, B & W. Learning Through Seeing, Box 368, Sunland, California. (Use to show basic steps in short-exposure processes.)

Teaching Machines and Programed Learning. 16mm motion picture. NEA. B & W. 29 min. (Use to study the medium of teaching machines.)

Television in Education. 16mm motion picture. Bell Telephone. Color. 30 min. (Use to explore the instructional value of this medium and its unique characteristics.)

To Speak with Friends. 16mm motion picture. NEA (U.S. Office of Education). B & W. 28 min. (Use to explore tape techniques and operations in a language laboratory.)

Unique Contribution. 16mm motion picture. Encyclopaedia Britannica Films. Color. 30 min. (Suggested as a means of illustrating the motion picture medium.)

Using Maps and Globes. Filmstrip, 48 frames, color. Rand McNally Co. (Use to explore the graphic medium, and identify the nature of uses portrayed.)

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3

CREATIVE DESIGN THROUGH BASIC PRINCIPLES

Because of the power of many of the technological materials to compel interest, many teachers use them for that purpose only. That is, the teachers use the material just to introduce a topic, or, more naively, because they believe seeing the material may have value in some way at some future time. Teachers need to perceive these materials as the means of accomplishing recognized ends. Effective use simply means using materials efficiently to achieve valid teaching objectives. Thus teacher competence in this field arises from a complex of beliefs, commitments to action, and the ability to make up a set of unique decisions about what to select, and what to do or say, when what has been selected is presented in class.

This chapter explains and suggests a system of principles, not a recipe, but a linked series of guideposts, that calls for creative teacher action. Five principles will be stated and related to teacher performance with the entire range of audiovisual materials.

How to Select Audiovisual Materials

THE PRINCIPLE OF SELECTION

The first critical task in using audiovisual teaching materials effectively is to find and choose the materials that meet pupil needs and interests, are suitable for pupil levels of maturity and experience, deal appropriately with subject-matter areas under study, and will help students solve their problems.

Statement of the Principle. The first guiding principle is as follows: *Teachers should base their selection of high quality audiovisual materials upon valid teaching purposes (objectives) and upon the unique characteristics of a specific group of learners.* Very simply, the crucial aspects of the principle are production quality of the material, the purpose to be achieved by the teacher through its use, and student characteristics.

Teaching Purposes. Many teachers choose films, slides, and models because they seem to coincide with subject-matter content in a given textbook. The best way is to choose any given kind of audiovisual material, whether it is a television program or filmstrip, model or field trip, because it will help students to acquire specific insights, like the understanding that *all living things must have food, water, and air to survive*; help to develop the ability to perform a specified operation, like the ability to *make accurate observations*; and help to develop proper attitudes like *open-mindedness*, for example, and appreciations of such actions as *good planning and clear thinking*.

To have teaching purposes in mind is a crucial requirement because teachers will then find it easier to originate, or originate *with* students participating, valid learning activities. That is, they will be better able to identify projects, problems, and questions, and to initiate discussions and readings. Therefore it must be pointed out that teaching purposes are not taught apart from valid problem-solving activities. The true relationship is that a given material, whether it is a textbook or film, is chosen not only for a specific educational objective, but also because of the problems or assignments that valid objectives appear to demand.

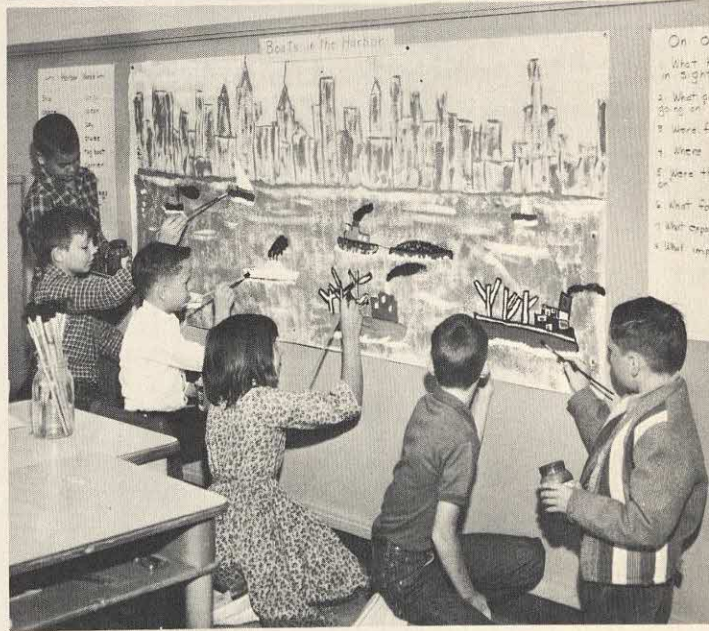
This discussion of purpose would be incomplete if it failed to raise a pertinent question, namely, what is the difference between the *teacher's purpose* and the *pupil's purpose*? Many teachers are not clear about this, and the inevitable resulting confusion detracts from efficiency of classroom procedure. The answer is simple enough. The *teacher's purpose* is the educational objective, the identifiable understandings, abilities, attitudes, and appreciations that are to be built into the learner as a result of his activity. *Pupil purpose* is the student goal, the problem, the assignment, and the job that he has accepted and is trying or will try to complete. Thus it is readily seen that a film, filmstrip, or tape may not only present subject matter that is to be memorized, but it may also give directions for action, provide a unique vicarious experience, provide information that will help a learner or class of learners make valuable decisions, construct an exhibit, write a series of articles, or prepare an assembly program.

Since the vital ability to formulate valid teaching purposes is a prime



Figure 3-1. This teacher wants this large-scale classroom project completed, but is this her real professional purpose? Just what is the pupils' purpose? Is it to learn geographic relationships, ability to work together, or to use reference material to find needed facts? Or to get the assignment completed? Teachers need to be right about these questions, or they will make serious mistakes in their professional thinking and planning. If you are not sure about the answers to the questions raised, consult information in this section of the text. (Courtesy San Diego City Schools, San Diego, Calif.)

Figure 3-2. Making these paper mache animals and this mural become challenging problems. What should pupils learn? How to make a model or use a brush? These would only be incidental outcomes. What information do they need to find? Note the research that is called for in answering the questions about *Boats in the Harbor*? What conditions for learning do teachers need to arrange? How to organize pupil study activity? What motion pictures, filmstrips, and books need to be shown to facilitate work on these problems? What materials need to be set out, then cleaned and put away? (Courtesy La Mesa Spring Valley School District, La Mesa, Calif.)



requirement for all beginning teachers, and since, at least for the present, there appears to be a general need for even experienced teachers to improve their ability to formulate valid teaching objectives, appropriate additional emphasis, including criteria and examples, will be given in Chapter 4.

Characteristics of the Group. The characteristics of individuals are many and complicated in any given group of learners. These varied characteristics influence the teacher in the selection of material, whether it is tape or filmstrip, for a given teaching situation. Several examples will suffice to show the nature of the judgment required. *First*, it is vitally important to know the students' maturity and experience background to

predict whether the content is too easy or too difficult, and for existing defects, whether the materials will impede learning or waste time. *Second*, the underlying concerns of specific age groups should also be borne in mind when considering group characteristics. Psychologists have referred to the fundamental concerns of particular age groups as "developmental tasks." These tasks are largely concerned with common social and physical adjustments, and hence vary with maturity. The competent teacher must also relate this knowledge to the selection of audiovisual materials. Tryon and Henry, when discussing the developmental tasks of late childhood, stated:

Most children spend much time during later childhood in exploring the realities of the physical world and of learning how to gain greater control over them. The child is a physicist, zoologist, chemist, astronomer, and lots more rolled into one.¹

We shall simply say by contrast that in high school students are much more concerned with value systems, economics, vocations, and dating and mating. By being aware of such basic mental conditions, teachers may then choose the materials and learning experiences as well as ask particular questions that will possess a richer potential for pupil action and growth. *Third*, there is the problem of selecting the right material for a given age or grade level. Frequently, materials, films in particular, are listed in sourcebooks and catalogs as being suitable for use at all grade levels from elementary school through college. The teacher must be critical of the content of such materials as to what is known about a particular group and what content is needed to fulfill its needs.

Statement of Selection Criteria. The selection of a given film, film-strip, or slide set, may, even though carried out quickly, be a complex process because of the many factors entering into a final decision. Below is a listing of the general curriculum factors stated in question form that teachers need to consider as applying to all materials.

1. Will the materials be usable in direct relation to a teaching unit? To a specific experience, or problem-solving activity?
2. Is the content to be communicated by the material useful and important? To the pupil? To the community? To society?
3. Will the material make a contribution to major teaching purposes? (Or toward the major goals of the learners?)
4. Does the difficulty level of the teaching purposes (the understandings, abilities, attitudes, and appreciations) demand the help of the material being examined?

¹ Caroline Tryon and William E. Henry, "How Children Learn Personal and Social Adjustment," *Learning and Instruction*, Forty-Ninth Yearbook of the National Society for the Study of Education, Part 1 (Chicago: University of Chicago Press, 1950), p. 176.

5. Will the material be likely to call for vicarious experiencing, thinking, reacting, discussing, studying?
6. Is the content to be communicated presented in terms of problems and activities of the learners? (Logically arranged subject-matter may be called for at advanced levels of study.)
7. Is the content to be presented by the material sufficiently rich in concepts and relationships?
8. Does the material possess appropriate content that facilitates the process of inference? Size? Temperature? Weight? Depth? Distance? Action? Odor? Sound? Color? Lifelikeness? Emotion?
9. Is the material accurate, typical, and up to date?
10. Is the kind of material uniquely adapted to the achievement of the desired teaching objective?
11. Is the content in the material in good taste?
12. Could the materials be used conveniently within a regular class period?
13. Is the content of the material sufficiently rich in number of examples to warrant sound conclusions? That is, are both sides of an issue explored? Or if not, is the insufficiency pointed out? ²

A number of other factors that have to do with the ways a given audio-visual material was produced should also be considered by teachers, and these factors are described in the next paragraph.

Technical Qualities of the Material. There can be little doubt that the theater-going and television-viewing public of today has developed a taste for motion pictures of good technical quality. This is equally true about still pictures of all kinds as a result of the prodigious use of pictorial magazines in everyday life. In general, it is the task of teachers to select the best from the many materials that have been produced according to high standards of photographic composition and clarity, artistic balance and color, and educational content design.

Another aspect of technical quality that teachers must scrutinize in their selection of materials is the producer's modes of communication. The selection of materials on the basis of this criterion demands consideration of the motives of the producer, his concepts of education, and his methods of presenting the material as revealed in his finished product. For example, a producer with hidden motives may distort the facts by overemphasis of some, while obscuring or omitting others, or by deliberate misrepresentation. A producer may also, sincerely, merchandise materials of questionable value for primary grades, for example, because of his insufficient understanding of what young children like or how they learn. Still another example is the producer who cuts the cost of his production by using straight narration where synchronized dialogue would have improved the

² Items in this list appeared in the author's book, *Administering Audio-Visual Services* (New York: The Macmillan Company, 1959), pp. 144-145.

responses of observers. Teachers must also remember that particular modes of communication, although acceptable at one time, may be unacceptable the next decade or even the next year.

Materials should be accurate and of good quality, but even if they are not they may serve valid teaching purposes, providing errors and weaknesses are perceived by students under teacher guidance and related to their problems. Whenever defective materials are selected, teacher resourcefulness will be required if the defects are to be countered and turned to advantage.

Technical Quality Criteria. A list of relationships of general technical quality arranged in question format will help to unify the kinds of judgments teachers are required to make as they decide which materials are of acceptable quality.

1. Is technical quality of the material artistic?
2. Is the producer's mode of communication adequate for the purpose? That is, is the message put over clearly, forcefully, in ways that attract and hold attention?
3. Are physical size, format, and color satisfactory?
4. Is workmanship in the construction of the material adequate?
5. Is the content to be presented free of conflicts and distractions?
6. Was careful planning by the producer obvious in the content and structure of the material?
7. Did the producer of the material set out to produce the material for school audiences with competent educational consultants?³

Recognizing the Necessity for Teacher-Made Materials. The ability to select suitable technological materials for teaching purposes has thus far been discussed with proper emphasis upon those that are already available for distribution from commercial sources. It is important to stress, before continuing to the discussion of preuse examination and the use of source lists, the fact that teachers should also recognize the need for several kinds of audiovisual material that they themselves should prepare or have prepared. Such materials as listening-response tapes, slides in color or in black and white, acetate transparencies, displays, maps, models, and apparatus should nevertheless meet the criteria of the *selection principle*. We thus recognize that the *selection principle* includes a broad scope of materials, some of which must be planned and prepared in the classroom or in the school's graphic workroom.

It is true that skillful and mature teachers in school systems throughout the country are adding to their communicative skills the power to visualize, select, arrange, construct, photograph, and record unique content. Such

³ *Ibid.*, p. 145.



Figure 3-3. This teacher is preparing a transparency for use on an overhead projector. Note the rolls of pressure sensitive tape, assorted inks, and a box for a variety of pens, all conveniently at hand. Chapter 6 describes a number of basic production processes. What materials need to be visualized by teachers? What roles are such materials required to play? To overcome physical difficulties in presenting information? To control the responses of pupils? To explain difficult concepts? (Courtesy Board of Education, Norwalk, Conn.)

teachers have a greater impact, arising from increased pupil understanding. But there is also an additional aspect of the selection principle that we must not miss and this has to do with new group arrangements for instruction.

Selecting Audiovisual Media for Newer Teaching Arrangements. By selecting audiovisual media such as tape, television, and instructional kits, and making use of uniquely prepared materials, new class groupings and arrangements become possible. Large groups listen and respond to teacher presentations via recorded tape for example. Large classes divide according to flexible schedules and recombine for new and more efficient learning exercises. But here again, although new roles are played by the materials,



Figure 3-4. Many school-system media service centers supply teachers with catalogs of available material. Some of these are large and comprehensive, listing all materials, while others are very specific by grade and subject, listing specific kinds of material such as tapes, filmstrips, or suggested local field trips. These are list-type catalogs. (Photograph by David H. Curl, University of Connecticut, Storrs, Conn.)

the teacher selects such practices and media in the light of high quality, valid teaching purposes, and the unique characteristics of a group of learners.

Preuse Examination. It is obvious that valid teacher judgments cannot be made about materials without examination by viewing or hearing them. Catalog descriptions and reported judgments of other teachers and colleagues may help. However, some materials may contain embarrassing and disruptive content, and this situation is more likely to be encountered in motion pictures produced by other than bona fide school-material producing agencies. Furthermore, only when another teacher's purpose for using a given material is known should his recommendations be accepted.

Sources of Materials. Locating suitable audiovisual materials is not easy for the teacher either. The search must be made continuously by teachers everywhere, in audiovisual education journals, film library catalogs, subject-field magazines, special listings produced by schools and school systems, and catalogs of commercial producers and audiovisual dealers.

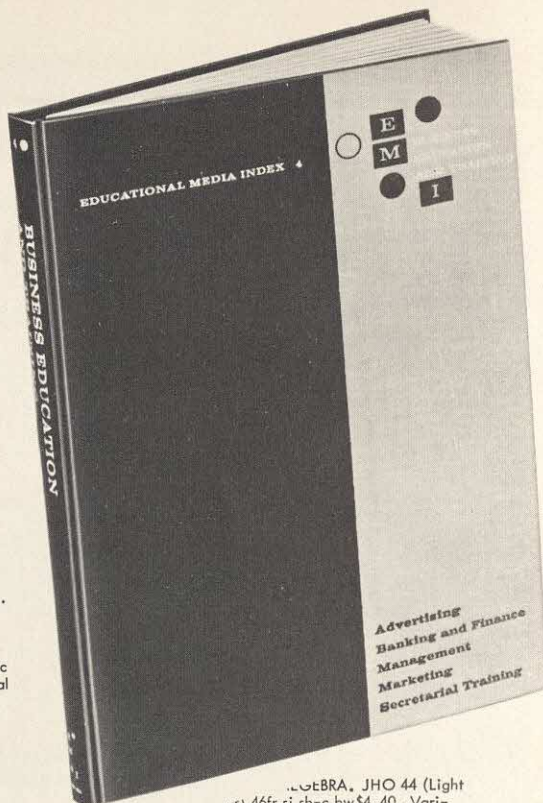
Teachers are fortunate when they teach in communities that support both school-system and school-building audiovisual technology service centers. In such communities teachers will find it easy to locate and select the materials they need. In others the difficulties are almost insurmountable. Here, however, is a listing of general references and suggestions that may prove to be helpful, in all situations:

1. Consult local school-system, school-building, and resource-center catalogs, paying particular attention to files of appraisals based on experience of actual use.
2. Peruse regularly such audiovisual technology magazines as *Audiovisual Instruction*, *Educational Screen and Audiovisual Guide*, and also subject-field journals.
3. Consult the new sourcebook of materials titled, *Educational Media Index*, published by McGraw-Hill Co., under special sponsorship. This publication is the first true sourcebook since it lists motion pictures, kinescopes, video-tapes, filmstrips, records, tapes, models, slides, transparencies, cross-media kits, and programed instruction.
4. Consult the *Educational Film Guide* for 1953, and for 1954-1958, plus Supplements through 1962, and also the *Filmstrip Guide* published by the H. W. Wilson Co. (1950 University Avenue, New York, N.Y.) However, this publication is no longer printed; hence only the annual supplements through 1962 and the two main volumes remain.

Figure 3-5. The card-type catalog is used by some school systems. Individual cards, each listing a given film, chart, or tape locally available, may be thus cross referenced under many different subjects, grade levels, and teaching unit categories. (Courtesy San Francisco City Schools, San Francisco, Calif.)



Figure 3-6. A long-awaited comprehensive sourcebook is this *Educational Media Index* in fourteen volumes, published under special sponsorship by McGraw-Hill Book Co. Such a sourcebook is of value in locating materials for procurement by teachers on a rental basis, or by local service centers for purchase. All of the major kinds of technological media are included. Supplements will be produced periodically. (*Educational Media Council and the McGraw-Hill Book Co., New York, N.Y.*)



algebra including basic concepts useful in further study of mathematics, applications to plane geometry, numerical trigonometry. Supplement. Manual available.

- ALGEBRA II. EBP 61 7373fr reusable plastic binder with slider \$13.25 jh-sh. Theoretical and practical considerations of algebra. First year algebra reviewed. Emphasis on factoring and logarithms. Supplement. Manual available.

- ALGEBRA I. CENCO 63 537fr h1 w5 reusable book \$2.95 4-6-jh-sh. Rules of algebraic operations, algebraic terms, equations, addition and subtraction of polynomials.

- ALGEBRA II. CENCO 63 468fr h1 w5 reusable book \$2.95 4-6-jh-sh. Simultaneous equations, algebraic expressions.

- ◀ ALGEBRA I. NITL 60 video 15ips sd 28min ea ETV jh bw w\$ tg. Basic instruction in traditional first year algebra for eighth or ninth grade students. Produced by South Carolina ETV Center. 160 lessons.

- ◀ ALGEBRA II. NITL 61 video 15ips sd 29min ea ETV jh-sh bw w\$ tg. Basic instruction in traditional second year algebra for ninth or tenth grade students. Produced by South Carolina ETV Center. 160 lessons.

- ◀ ALGEBRA IN EVERYDAY LIFE. CORF 48 16mm sd 11min jh-sh c\$120 bw\$50 tg. Three basic algebraic steps: observation, translation, manipulation, and computation. Use of algebra in everyday life.

- ALGEBRA REFRESHER. TMC 62 3313fr h2 w8 reusable book \$16 MIN/MAX II \$15 sh-c-ad. Discussion of number system, exponents, radicals, products and factoring fractions; linear, quadratic, fractional equations; verbal problems, rectangular coordinates, graphs, functions, ratio and proportion, logarithms.

- ◀ ALGEBRAIC AND COMPLEX FRACTIONS. MLA 16mm sd 29min sh bw\$150. Significance of fractional notation for algebraic symbols reviewed. Thus, a/b is compact form of operation a times $(1/b)$, and product of two

...ALGEBRA, JHO 44 (Light ... 46fr si sh-c bw\$4.40. Vari- ... quantities. Applying fundamental pro- ... cesses. Factoring.

- ◀ BEGINNING ALGEBRA I, LECTURE 3: FORMULAS. NF 56 16mm sd 30min ETV jh-sh-c bw w\$. Reviews basic algebraic formulas, explains order of operations, evaluation procedure.

- ◀ BEGINNING ALGEBRA I, LECTURE 5: DEPENDENCE OF QUANTITIES. NF 56 16mm sd 30min ETV jh-sh-c bw w\$. Tables, graphs, formulas to explain, demonstrate dependence of quantities.

- ◀ BEGINNING ALGEBRA I, LECTURE 9: FUNDAMENTAL OPERATIONS. NF 56 16mm sd 30min ETV sh-c-g&p bw w\$. Adding, subtracting monomials, polynomials. Use of parentheses.

- ◀ BEGINNING ALGEBRA I, LECTURE 10: FUNDAMENTAL OPERATIONS. NF 56 16mm sd 30min ETV sh-c-g&p bw w\$. Multiplication laws, use in multiplying, dividing monomials, polynomials.

- ◀ BEGINNING ALGEBRA II, LECTURE 9: RATIO, PROPORTION, AND VARIATION. NF 56 16mm sd 30min ETV sh-c-g&p bw w\$. Concepts of ratio, proportion, and variation, shows their use in solution of problems.

- THE CLOSURE, COMMUTATIVE, AND ASSOCIATIVE PROPERTIES OF REAL NUMBERS. CENCO (Modern Elementary Algebra) 50fr si jh-sh c\$6. Algebraic properties of numbers.

- ◀ COLLEGE ALGEBRA. NITL 62 video 15 ips sd 28min ETV sh-c bw w\$ tg. Basic instruction in traditional college algebra, can also be taught to advanced high school students. Produced by South Carolina ETV Center. 80 lessons.

- Film strip ■ Slides or transparencies
- Phonotape ■ Models, mock-ups, etc.
- Flat pictures ■ Film or kinescope
- Phonodisc ■ Cross-media kit
- Videotape ■ Charts or maps
- Programmed instruction material



Figure 3-7. This picture shows one of the main *Media* resource rooms at the Instructional Service Center of the San Diego City Schools. Teachers order materials from catalogs, or they may visit this center to consult with experienced staff members about their needs. (Courtesy San Diego City Schools, San Diego, Calif.)

Many copies, however, are still available in libraries and school audio-visual centers.

5. Consult the *Guides to Newer Media* by Margaret I. Rufsvold and Carolyn Guss, published by the American Library Association (50 East Huron, Chicago 11, Ill.) in cooperation with the U.S. Office of Education, 1961.
6. Consult *Educators Guide to Free Films*, and *Educators Guide to Free Slidefilms*, published annually by Educators Progress Service, Dept. AVG, Randolph, Wis. Many audiovisual centers have these publications also.
7. Write to such transparency material manufacturers as *Keuffel and Esser Co.*, *Audiovisual Division*, Hoboken, N.J.; *Tecnifax Corp.*, Holyoke, Mass.; and *Ozalid Co.*, Johnson City, N.Y. These companies are embarking on a production-of-transparencies program, in addition to manufacturing devices and supplies; and still other companies are specializing in ready-made transparencies only. The Appendix contains references to other sources and suppliers.
8. Consult film catalogs of the largest rental film libraries, for example



Figure 3-8. These pictures show a crew of student technicians and a staff member filling a filmstrip order from the large available supply. Also shown is a teacher discussing materials about to be taken back to her classroom for subsequent use. (*Courtesy Penfield Central Schools, Penfield, N.Y.*)

University of Illinois, Champaign; Indiana University, Bloomington; State University of Iowa, Iowa City; Pennsylvania State University, University Park; University of Texas, Austin; University of Washington, Seattle; and many others.

9. Write to local audiovisual education dealers for their listings.
10. Consult catalogs of companies that produce scientific equipment and also manufacturing promotional agencies, such as the Petroleum Institute, the Manufacturing Chemists' Association, and American Association of Railroads.

TEACHER PERFORMANCE

Here then is a statement of the teaching performance that the selection principle demands of competent teachers:

1. Identify and write out in clear and consistent form valid teaching purposes (the understandings, abilities, attitudes, and appreciations) that it is hoped to develop in the students.
2. Select specific audiovisual materials to make optimum contributions to the valid teaching purposes.
3. Use audiovisual media sourcebooks and catalogs.
4. Predict that an identified learning experience among many will influence students in desirable and specific ways.
5. Relate precisely various kinds of selected audiovisual materials to

- specific problems as they are being worked on by individuals and groups.
6. Select technological media for use in new and efficient ways to involve students in self-instruction processes and/or large-group methods.
 7. Select audiovisual materials to play a variety of instructional roles.
 8. Judge the quality and suitability of specific audiovisual materials on the basis of the interests, experience, maturity, and powers of comprehension of a specific group of learners.
 9. Plan and prepare the more simple, specialized audiovisual materials such as slides, transparencies, instructional tapes, and displays for the unique teaching purposes and processes.
 10. Design and produce such complex, specialized materials as magnetic sound motion pictures, radio and television programs, and instructional packages for classroom and/or school-system utilization.

How to Develop Readiness

Learner readiness is of great significance in the successful use of audiovisual materials. The attitude of learner readiness should be the continuing concern of every teacher regardless of the type of material used, whether it is a textbook, film, or television program. As considered in this discussion, readiness is basically a feeling of need to participate in the audiovisual experience. It is the kind of conviction of the learner which, if expressed in words might be: "I am interested. I am ready and willing to see, hear, and take action."

Mort, in discussing interest as an indication of readiness for learning, made this succinct statement:

We don't teach to get interest, but when we don't get interest our teaching isn't prospering. Interest is an index of where the organism is ready to grow. Not all interests need to be followed any more than all limbs on a tree need to be allowed to develop; we select and encourage the limbs that sprout in the desirable places . . . It (interest) is clearly a means and not an end.⁴

It is the factor of "interest" built up by the deliberate action of the teacher, as a natural consequence of previous learner experiences, or as a consequence of need recognized by the pupil (for example, a problem on which he has agreed to work), that will determine the quality of the pupil's reaction to audiovisual materials. And it is this reaction that will ultimately determine the quality of the learning outcomes.

⁴ Paul R. Mort, *Principles of School Administration* (New York: McGraw-Hill Book Co., 1946), p. 42.

THE PRINCIPLE OF READINESS

Statement of the Principle. The second guiding principle is: *The use of audiovisual instructional materials should be preceded by the development of adequate learner readiness for effective participation.* When teachers know why they are using films, slides, charts, models, etc., the job of developing readiness in students is easier to fulfill. For example, if a teacher wanted to develop the ability to interpret a specific type of mechanical drawing, it would be easy to suggest the highly pertinent aspects of a given film that students should observe.

Some Readiness Techniques. Students need to feel that an activity is important to them, and often this can be accomplished by telling them how a particular material will contribute to important learning results. Perhaps the best way to develop readiness is to set up one or more problems or tasks and then explain that the film or filmstrip, or set of slides, will help define, analyze, and provide directions for the necessary solution. Teachers who use the illustrated lecture method may greatly enhance communication through questions and problems that are raised as a preface to using charts, slides, etc. However, problem-solving (answering questions and formulating new responses) activity needs to be a dominating characteristic of the teaching-learning process, and thus it is reasonable that the use of audiovisual materials should either lead to the raising of problems, or be preceded by the identification of problems. The following are suggested as examples of what to do or say prior to the use of audiovisual materials.

1. Give an introductory talk, describe a case, or tell about an incident that introduces the content to be presented.
2. Set up a problem or assignment to focus attention on a felt need for learning, or raise a series of questions, perhaps writing them on the chalkboard, or handing them out in duplicated-sheet form. (Here it should be noted that it is essential to have teaching purposes in mind because otherwise proper questions and assignments will be appropriate and pertinent only by chance.)
3. Tell how the content to be presented by film, model, or demonstration is related to previous experience, future plans and assignments, or on-the-job performance.
4. Direct attention of students to key processes, issues, or ideas consistent with teaching objectives. Perhaps three to five references of this nature would be sufficient. Before using lengthy motion pictures or long sets of slides, such items singled out for observation should be written

down by the pupil, or handed to him in duplicated form for future reference.

5. Point out some difficulties that will be encountered.
6. When using unusually realistic materials state that the materials provide opportunity to "travel" to the location for on-the-spot observation.

One or more of these factors and other choices of action will very likely stimulate students to either greater mental or physical participation. Following the readiness principle means that *plans of action* to launch students into fruitful thought processes *will be in mind and will be implemented*.

TEACHER PERFORMANCE

Here then is a statement of the teaching performance that the *readiness principle* demands of competent teachers:

1. Develop a specific readiness plan of what to do or say.
2. Guide learners in setting up individual or group needs for the material selected.
3. Relate properly specific audiovisual material to specific pupil problem-solving activities.
4. Employ a variety of methods for building *readiness* in pupils, including the problem-base procedure of building readiness by setting up a class problem before the materials are presented, and including readiness plans in written form for each pupil for use in self-instruction processes, for any specific audiovisual material or combination of materials.
5. Use a number of sources of information in making decisions about readiness such as teaching purposes and knowledge of pupil characteristics.

How to Make Suitable Physical Arrangements

THE PHYSICAL CONTROL PRINCIPLE

The next logical step in utilization of audiovisual teaching materials is with the control of conditions that facilitate learner attention and action.

Statement of the Principle. The third guiding principle may be

stated as follows: *Details relating to physical facilities and conditions for using audiovisual materials should be handled or arranged by the teacher in a manner that safeguards material and equipment and provides for economy of time and optimum learner attention.*

Basic Classroom Conditions. The teacher must become an excellent organizer if the previously stated principle is to be followed. If he does not have to operate his own equipment (motion picture projectors, etc.) he still needs to plan the action and in general assume command. By bearing in mind all of the kinds of audiovisual materials, there are six basic classroom conditions that should be met.

CONDITION 1: SUFFICIENT DARKNESS TO PERMIT THE VIEWING OF BRIGHT, IMPRESSIVE PROJECTED IMAGES. In meeting this requirement teachers must remember the crucial insight that various instructional tasks require varying amounts of illumination. For optimum viewing of television screens room lighting should be dimmed by closing all Venetian blinds or other light-diffusing shades. For direct exposure to sunlight, teachers should close the classroom's darkening system completely and use dimmed room lights. When notes and drawings, for example, have to be made during projection, dim light is a necessity; however, when students are required to evaluate difference in shades of color, as in observation of camouflage, or to view a projected image of microscopic material with a microprojector, the room may have to be darkened to the limit of the darkening system. Stray light rays may not only cause difficulty in viewing projected images, but may also cause glare on chalkboards. Because of these circumstances teachers must check critically the viewing conditions in their classrooms in terms of the kinds of observations pupils need to make and respond to during their learning activities. But just as the classroom needs to be darkened for picture projection, it needs to be brightened for reading as well as laboratory and other observations. Hence teachers should use the expression *light control* in thinking about their lighting problems.

CONDITION 2: APPROPRIATE PLACEMENT OF PROJECTORS AND TELEVISION RECEIVERS, PROJECTION SCREENS, AND PUPILS. The vital aspect of this condition is that pupils should be able to see clearly without undue strain and distraction. Because of the nature of reflected characteristics of projection screen surfaces, some pupils seated at the extreme sides of a room, particularly near the front, may be forced to look at pictures that can barely be recognized because of dimness and distortion. The teacher should arrange classroom conditions for optimum viewing and study; fortunately, the rules are few and easy to understand. *Condition 2* will be easy to meet if the following advice is heeded.

(a) Ascertain if the projection screen has a glass-beaded or matte fabric.

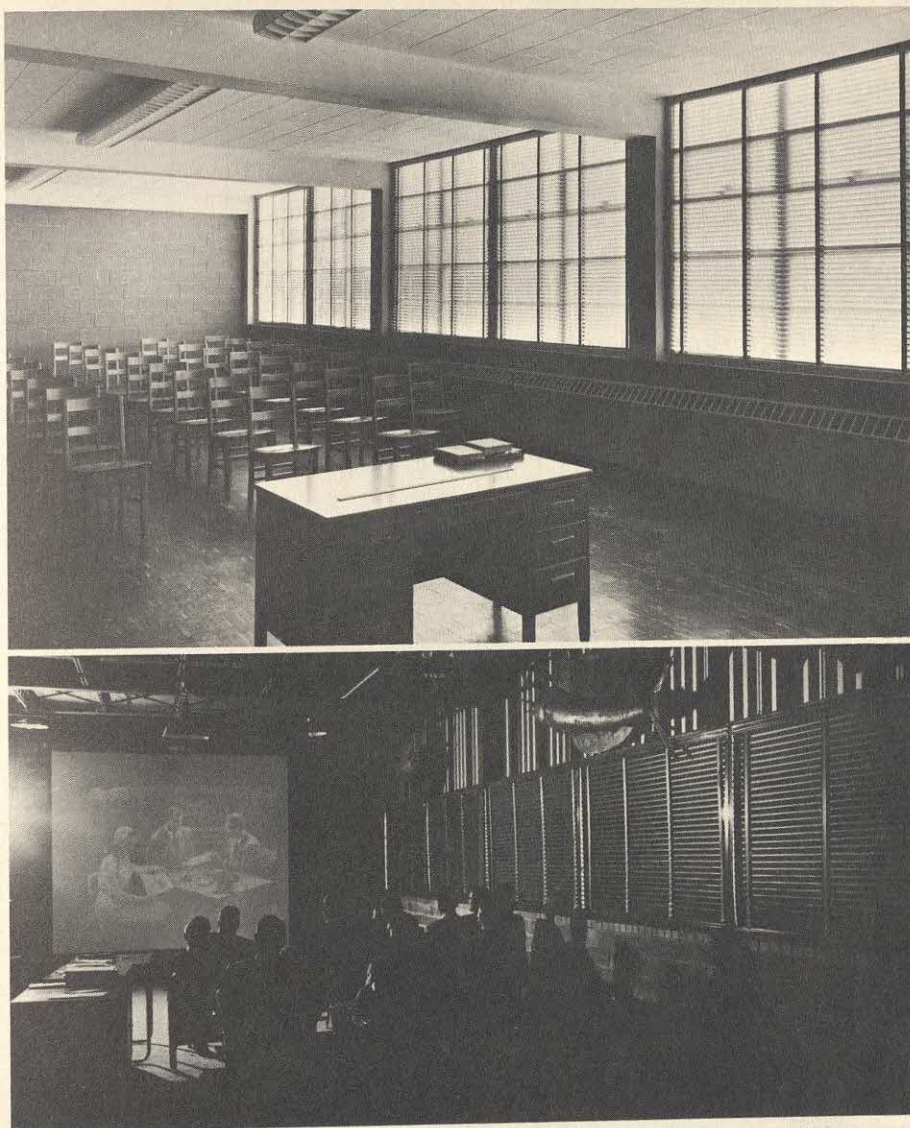


Figure 3-9. Full-closure Venetian blinds like the ones shown permit varying degrees of light diffusion and exclusion as needed for various instructional tasks. One of the basic conditions for learning that administrators need to help teachers provide is optimum brightness or dimness. Shown in the pictures are Flexalum Audio-Visual Blinds. (Courtesy Hunter Douglas Division of the Bridgeport Brass Company, Bridgeport, Conn.)

If screen is glass-beaded, arrange pupils within the limits of a total observation angle of 45 degrees with reference to the axis, an imaginary perpendicular line running from the projector to the screen surface. The total observation angle would be in this case 22.5 degrees on each side of the axis. If the screen fabric has a matte, or flat white surface, pupils may be arranged farther out on the sides since the light does not "fall off" as

35MM SINGLE FRAME FILMSTRIPS

APERTURE WIDTH — .885"

LENS FOCAL LENGTH	SCREEN WIDTH													
	40''	50''	60''	70''	84''	8'	9'	10'	12'	14'	16'	18'	20'	
3''	11.3	14.1	16.9	19.8	23.7	27.1	30.5	33.9	40.7	47.5	54.2	61.0	67.8	
4''	15.1	18.8	22.6	26.4	31.6	36.2	40.7	45.2	54.2	63.3	72.3	81.4	90.4	
5''	18.8	23.5	28.2	32.9	39.5	45.2	50.8	56.5	67.8	79.1	90.4	101.7	113.0	
6''	22.6	28.2	33.9	39.5	47.5	54.2	61.0	67.8	81.4	95.0	108.5	122.0	135.6	
7''	26.4	32.9	39.5	46.1	55.4	63.3	71.2	79.1	94.9	110.7	126.6	142.4	158.2	
8''	30.1	37.7	45.2	52.7	63.3	72.3	81.4	90.4	108.5	126.5	144.6	162.7	180.8	

2" x 2" DOUBLE FRAME 35MM SLIDES

APERTURE WIDTH — 1.34"

LENS FOCAL LENGTH	SQUARE SCREEN SIZE													
	40"	50"	60"	70"	84"	8'	9'	10'	12'	14'	16'	18'	20'	
3"	7.5	9.3	11.2	13.1	15.7	17.9	20.1	22.4	26.9	31.3	35.8	40.3	44.8	
4"	10.0	12.4	14.9	17.4	20.9	23.9	26.8	29.9	35.8	41.8	47.8	53.8	59.7	
5"	12.4	15.5	18.7	21.8	26.1	29.9	33.6	37.3	44.8	52.2	59.7	67.2	74.6	
6½"	16.2	20.2	24.3	28.3	34.0	38.8	43.7	48.5	58.2	67.9	77.6	88.8	97.0	
7"	17.4	21.8	26.1	30.5	36.6	41.8	47.0	52.3	62.7	73.1	83.6	94.0	104.5	
8½"	21.1	26.4	31.7	37.0	44.4	50.7	57.1	63.4	76.1	88.8	101.5	114.2	126.9	
10"	24.9	31.1	37.3	43.5	52.2	59.7	67.2	74.6	89.6	104.5	119.4	134.3	149.3	
12½"	31.1	38.9	46.6	54.4	65.3	74.6	84.0	93.3	111.9	130.6	149.3	167.9	186.6	
15½"	39.3	48.1	57.8	67.5	81.0	92.5	104.1	115.7	138.8	161.9	185.1	208.2	231.3	
20"	49.8	62.2	74.6	87.1	104.5	119.4	134.3	149.3	179.1	209.0	238.8	268.7	293.5	

2 1/4" x 2 1/4" SLIDES

APERTURE WIDTH — 2.1875"

APERTURE WIDTH — 2.1875													
LENS FOCAL LENGTH	SQUARE SCREEN SIZE												
	40''	50''	60''	70''	84''	8'	9'	10'	12'	14'	16'	18'	20'
5''	7.6	9.5	11.4	13.3	16.0	18.3	20.6	22.9	27.4	32.0	36.6	41.1	45.7
6½''	9.9	12.4	14.9	17.3	20.8	23.8	26.7	29.7	35.6	41.6	47.5	53.5	59.4
7''	10.7	13.3	16.0	18.7	22.4	25.6	28.8	32.0	38.4	44.8	51.2	57.6	64.0
8½''	13.0	16.2	19.4	22.7	27.2	31.1	35.0	38.9	46.6	54.4	62.2	69.9	77.7
10''	15.2	19.0	22.8	26.7	32.0	36.6	41.1	45.7	54.8	64.0	73.1	82.3	91.4
12½''	19.0	23.8	28.6	33.3	40.0	45.7	51.4	57.1	68.6	80.0	91.4	102.8	114.3
15½''	23.6	29.5	35.4	41.3	49.6	56.7	63.8	70.9	85.0	99.2	113.4	127.5	141.7
20''	30.5	38.0	45.7	53.3	64.0	73.1	82.3	91.4	109.7	128.0	146.3	164.6	182.8
24''	36.6	45.7	54.6	64.0	76.8	87.8	98.8	109.7	131.6	153.6	175.5	197.5	219.4

3 1/4" x 4" SLIDES (LANTERN)

APERTURE WIDTH — 3.0"

LENS FOCAL LENGTH	SCREEN WIDTH											
	50"	60"	70"	84"	8'	9'	10'	12'	14'	16'	18'	20'
6"	8.3	10.0	11.7	14.0	16.9	18.0	20.0	24.0	28.0	32.0	36.0	40.0
6 1/2"	9.0	10.8	12.6	15.2	17.3	19.5	21.7	26.0	30.3	34.7	39.0	42.3
8"	11.1	13.3	15.5	18.7	21.3	24.0	26.7	32.0	37.3	42.7	48.0	53.3
8 1/2"	11.8	14.2	16.5	19.8	22.7	25.5	28.3	34.0	39.7	45.3	51.0	56.7
10"	13.9	16.7	19.4	23.3	26.7	30.0	33.3	40.0	46.7	53.3	60.0	66.7
12"	16.7	20.0	23.3	28.0	32.0	36.0	40.0	48.0	56.0	64.0	72.0	80.0
12 1/2"	17.4	20.8	24.3	29.2	33.3	37.5	41.7	50.0	58.3	66.7	75.0	83.3
14"	19.4	23.3	27.2	32.7	37.3	42.0	46.7	56.0	65.3	74.7	84.0	93.3
15"	20.8	25.0	29.2	35.0	40.0	45.0	50.0	60.0	70.0	80.0	90.0	100.0
15 1/2"	21.5	25.8	30.1	36.2	41.3	46.5	51.7	62.0	72.3	82.7	93.0	103.3
16"	22.2	26.7	31.1	37.3	42.7	48.0	53.3	64.0	74.7	85.3	96.0	106.7
18"	25.0	30.0	35.0	42.0	48.0	54.0	60.0	72.0	84.0	96.0	108.0	120.0
20"	27.8	33.3	38.9	46.7	53.3	60.0	66.7	80.0	93.3	106.7	120.0	133.3
22"	30.6	36.7	42.8	51.3	58.7	66.0	73.3	88.0	102.7	117.3	132.0	146.7
24"	33.3	40.0	46.7	56.0	64.0	72.0	80.0	96.0	112.0	128.0	144.0	160.0
26"	36.1	43.3	50.6	60.7	69.3	78.0	86.7	104.0	121.3	138.7	156.0	173.3

OPAQUE PROJECTION

APERTURE WIDTH — 10"

APERTURE WIDTH		SQUARE SCREEN SIZE						
LENS FOCAL LENGTH		50"	60"	70"	84"	8'	10'	12'
18"	Projection Distance in Feet	7.5	9.0	10.5	12.6	14.4	18.0	21.6
22"		9.2	11.0	12.8	15.4	17.6	22.0	26.4
26"		10.8	13.0	15.2	18.2	20.8	26.0	31.2

Figure 3-10. These screen-size tables are included to provide opportunity to study the relationship of the focal length of any given lens size to a specified kind of projected image at a given distance. Image size is approximated in these tables by the size of screen recommended. These tables should be studied in connection with Figure 3-12 and other illustrations in the text. (Courtesy Da-Lite Screen Company, Inc., Warsaw, Ind.)

OVERHEAD PROJECTION

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LENS FOCAL LENGTH	APER- TURE SIZE	SQUARE SCREEN SIZE										
		50"	60"	70"	84"	8'	10'	12'	14'	16'	18'	20'
6 1/2"	5"	5.4	6.5	7.6	9.1	10.4	13.0	15.6	18.2	20.8	23.4	26.0
12"	7"	7.1	8.6	10.0	12.0	13.7	17.1	20.6	24.0	27.4	30.9	34.3
12 1/2"	7"	7.4	8.9	10.4	12.5	14.3	17.9	21.4	25.0	28.6	32.1	35.7
8.8"	10"	3.7	4.4	5.1	6.2	7.0	8.8	10.6	12.3	14.1	15.8	17.6
12.5"	10"	5.3	6.3	7.3	8.8	10.0	12.5	15.0	17.5	20.0	22.5	25.0
14"	10"	5.8	7.0	8.2	9.8	11.2	14.0	16.8	19.6	22.4	25.2	28.0
15 1/2"	10"	6.5	7.8	9.0	10.9	12.4	15.5	18.6	21.7	24.8	27.9	31.0
18"	10"	7.5	9.0	10.5	12.6	14.4	18.0	21.6	25.2	28.8	32.4	36.0
22"	10"	9.2	11.0	12.8	15.4	17.6	22.0	26.4	30.8	35.2	39.6	44.0
24"	10"	10.0	12.0	14.0	16.8	19.2	24.0	28.8	33.6	38.4	43.2	48.0
26"	10"	10.8	13.0	15.2	18.2	20.8	26.0	31.2	36.4	41.6	46.8	52.0
30"	10"	12.5	15.0	17.5	21.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0
36"	10"	15.0	18.0	21.0	25.2	28.8	36.0	43.2	50.4	57.6	64.8	72.0
40"	10"	16.7	20.0	23.3	28.0	32.0	40.0	48.0	56.0	64.0	72.0	80.0

16MM MOTION PICTURES APERTURE WIDTH — .380"

LENS FOCAL LENGTH	SCREEN WIDTH																	
	40''	50''	60''	70''	84''	8'	9'	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
5/8''	5.5	6.9	8.2	9.6	11.5	13.2	14.8	16.4	19.7	23.0	26.3	29.6	32.9	36.2	39.5	42.8	46.1	49.3
1''	8.8	11.0	13.2	15.4	18.4	21.1	23.7	26.3	31.6	36.8	42.1	47.4	52.6	57.9	63.2	68.4	73.7	78.9
1½''	13.2	16.4	19.7	23.0	27.6	31.6	35.8	39.5	47.4	55.3	63.2	71.1	78.9	86.8	94.7	102.6	110.5	118.4
2''	17.5	21.9	26.3	30.7	36.8	42.1	47.4	52.6	63.2	73.7	84.2	94.7	105.3	115.8	126.3	136.8	147.4	157.9
2½''	21.9	27.4	32.9	38.4	46.1	52.6	59.2	65.8	78.9	92.1	105.3	118.4	131.6	144.7	157.9	171.1	184.2	197.4
2¾''	24.0	30.2	36.2	42.2	50.7	57.9	65.1	72.4	86.8	101.3	115.8	125.0	144.7	159.2	173.7	188.2	202.6	217.1
3''	26.3	32.9	39.5	46.1	55.3	63.2	71.1	78.9	94.7	110.5	126.3	142.1	157.9	173.7	189.5	205.3	221.1	236.8
3½''	30.7	38.4	46.1	53.7	64.5	73.7	82.4	92.1	110.5	128.9	147.4	165.8	184.2	202.6	221.1	239.5	257.9	276.3
4''	35.1	43.9	52.6	61.4	73.7	84.2	94.7	105.3	126.3	147.4	168.4	189.5	210.5	231.6	252.6	273.7	294.7	315.8

8MM MOTION PICTURES APERTURE WIDTH — .172"

LENS FOCAL LENGTH	SCREEN WIDTH									
	40''	50''	60''	70''	84''	8'	9'	10'	12'	
9/16''	10.9	13.6	16.4	19.1	22.9	26.2	29.4	32.1	39.2	
3/4''	14.5	18.2	21.8	25.5	30.5	34.9	39.2	43.6	52.3	
22 mm.	16.8	21.0	25.2	29.4	35.3	40.3	45.4	50.4	60.5	
1''	19.3	24.2	29.1	33.9	40.7	46.5	52.3	58.2	69.8	
1 1/4''	24.2	30.3	36.3	42.4	50.9	58.2	65.4	72.7	87.3	

2" x 2" SUPER SLIDES APERTURE WIDTH — 1.5"

LENS FOCAL LENGTH	SQUARE SCREEN SIZE											
	40"	50"	60"	70"	84"	8'	9'	10'	12'	14'	16'	20'
3"	6.7	8.3	10.0	11.7	14.0	16.0	18.0	20.0	24.0	28.0	32.0	40.0
4"	8.9	11.1	13.3	15.6	18.7	21.3	24.0	26.7	32.0	37.3	42.7	53.3
5"	11.1	13.9	16.7	19.4	23.3	26.7	30.0	33.3	40.0	46.7	53.3	66.7
6 1/2"	14.4	18.1	21.7	25.3	30.3	34.7	39.0	43.3	52.0	60.7	69.3	86.7
7"	15.6	19.4	23.3	27.2	32.7	37.3	42.0	46.7	56.0	65.3	74.7	93.3
8 1/2"	18.9	23.6	28.3	33.1	39.7	45.3	51.0	56.7	68.0	79.3	90.7	113.3
10"	22.2	27.8	33.3	38.9	46.7	53.3	60.0	66.7	80.0	93.3	106.7	133.3
12 1/2"	27.8	34.7	41.7	48.6	58.3	66.7	75.0	83.3	100.0	116.7	133.3	166.7
15 1/2"	35.1	43.1	51.7	60.3	72.3	82.7	93.0	103.3	124.0	144.7	165.3	206.7
20"	44.4	55.5	66.6	76.4	93.3	106.7	120.0	133.3	160.0	186.7	213.3	266.7

fast. The total observation angle in this case would be at least 60 degrees. In any case the teacher should make sure that students in the side-row positions are able to make the kind of observations required. The glass-beaded fabric is approximately 300 per cent brighter than the matte surface for pupils seated along the axis; however, beyond the stated viewing angle the reflecting power of the matte surface exceeds that of the glass-beaded surface.

(b) Stop unrolling the screen fabric when the bottom of the projection screen surface reaches a point approximately at the top of the seated pupils' heads. This will eliminate objectionable shadows on the screen during projection. Normally this level will be reached when the bottom of the screen fabric is one foot above the chalk tray, provided the level of the chalk tray is appropriate for the pupils in the class.

(c) Avoid seating pupils closer to the screen than two picture widths, and no farther away than six picture widths. Thus, if the projected image is five feet wide, no pupil should be seated closer than ten feet to the screen, and no one should be seated farther away than 30 feet. Viewing distances of less than $2W$ (two times the picture width) will likely result in eyestrain, and, when using glass-beaded fabrics, an annoying bead pattern may be observed. Viewing distances greater than $6W$ may not be objectionable if details of the projected image are large enough to be visible, such as in close-up photography.

(d) Arrange an aisle whenever possible to facilitate using a number of projectors as in the multi-media projection system, or plan to use 42-inch high projection stands at the rear of the room. In projection situations in the rear of the room, special long-throw lenses may be needed, that is, lenses with a longer focal length that will project smaller size pictures from the same distance. Long-throw lenses are generally unavailable for the overhead and opaque projectors, and these, together with other projectors using special short-throw lenses, must be used in front-of-room locations. Thus, pupils may have to be moved out of regular seats to new locations in the room to provide needed operational space. One of the simplest operations to decrease the size of a projected image is to move the projector closer to the screen. And of course to make a picture on a screen larger one has only to move the projector toward the rear.

(e) The distance of seats for television viewing may generally exceed the limitations of the $6W$ rule, but the last row of seats should be no farther away than approximately 20 feet when a 24-inch tube is used. Just as the $6W$ rule applies to regular projection screens and projected images, the $12W$ rule applies to the distance of students from a television receiver. However, the $12W$ rule will not apply unless the objects are large enough to be visible on the screen from that distance or are being shown by close-up camera angles. Pupils may also be seated within a total viewing angle to



Figure 3-11. This television receiver is being used in the center-of-the-room position. Are any of the students in this picture sitting outside of the recommended observation angle for a television tube? When will distortion at the extreme sides be critically objectionable? For extreme close-up views, can students be seated even beyond the 12W limit and yet see the object clearly? The projection screen is mounted on brackets that extend approximately eight inches from the wall. In this situation is this an advantage? Is the screen high enough? (Courtesy South Carolina ETV Network, Columbia, S.C.)

90 degrees. Television receivers may be placed in the corners as well as in centers of classrooms, but they need to be elevated to approximately five feet above the floor for line-of-sight screen visibility.

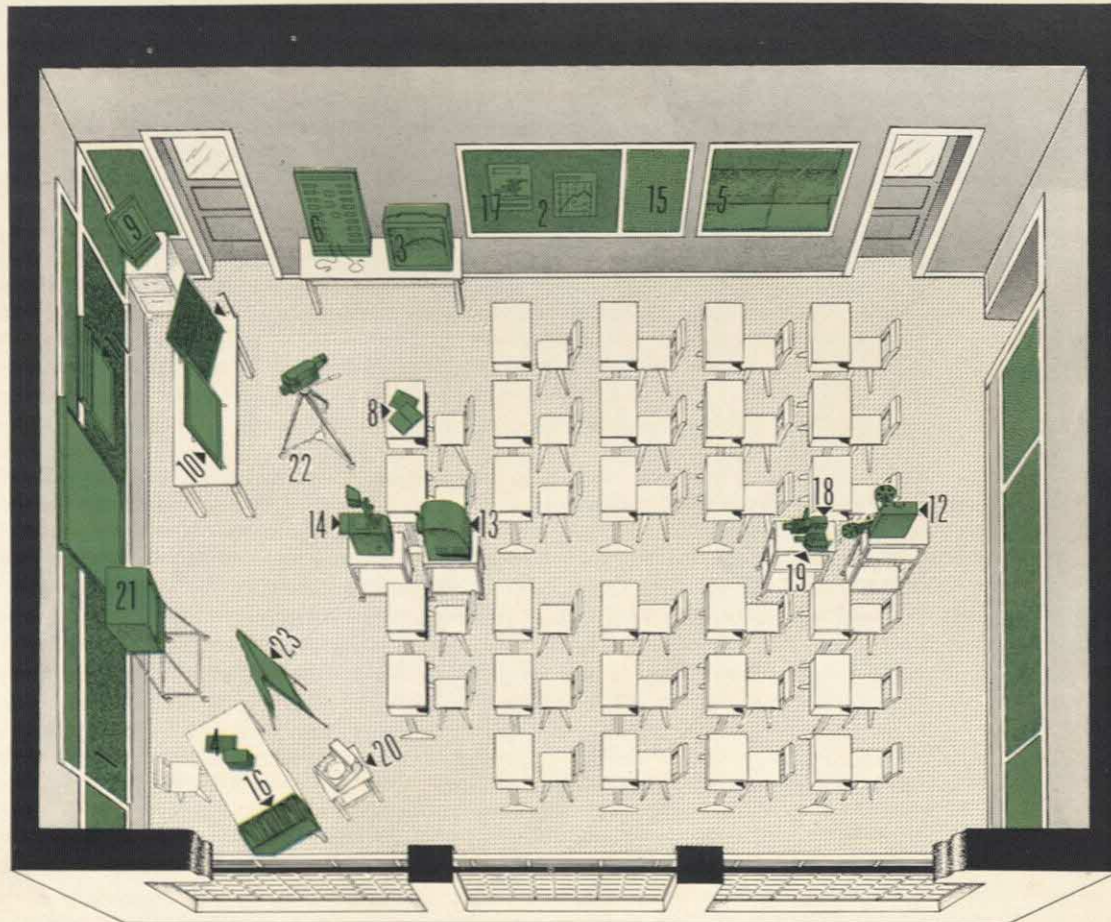
The illustrations will clarify the recommended arrangements and aid teachers in making decisions that will meet the specified conditions described in this section.

CONDITION 3: PROPER PLACEMENT OF LOUD-SPEAKERS AND SOUND EQUIPMENT FOR EFFORTLESS LISTENING. Ideally all loudspeakers and all sound equipment such as tape recorders and record players should be positioned at the ear level of seated pupils on a table or stand in the front of the room and beamed at the center of the class. Teachers should choose either center or side locations, depending on whether projection screens have to be in use at the same time. Hence tape recorders and record players should be positioned at the front center if they are used alone, or near front corners when used

Figure 3-12. In such a classroom as represented in this drawing by Harvey R. Frye of Indiana University, it is relatively convenient for the teacher to plan and implement the use of a wide range of instructional media. The professional job of the teacher is to arrange optimum conditions for learning. Some of these conditions are related specifically to the physical arrangements for media. This classroom diagram is presented to assist teachers in developing understanding and skill in establishing the six basic conditions for using audiovisual technology as discussed in the preceding pages. While acquiring the ability to control these basic conditions the reader should work through the following sequence of responses in relating the preceding text material to this particular classroom situation:

- A. Does the light control system for the windows appear to be similar to the full-closure blinds shown in Figure 3-9? (See Condition 1.)
- B. Identify the projection screen at the front of the room. Assume that the projection screen has a glass-headed fabric. Lay a sheet of clear acetate over the diagram and, using a grease pencil, draw a line from the motion picture projector #12 perpendicular to the center of the screen. Now draw straight lines from the screen out to the sides that make a total observation angle of 45 degrees, 22.5 degrees on each side of the perpendicular line. (See Condition 2 a.)
- C. Assume that this is a high school classroom. Does it appear that with the bottom of the screen rolled down to the chalktray there would be shadows from students' heads? Would a height of 48 inches for the bottom of the screen fabric be likely to be above the shadow level? If you plan to project a film, what would you do with the opaque projector on its stand if the top of this instrument were higher than the bottom of the screen? How would you mark the position on the floor for its quick return for use at the end of a film showing? (Masking tape? A chalk mark?) (See Condition 2 b.)
- D. Measure the width of the screen and then draw a line to the first row of desks. Is this distance approximately twice the width of the screen? Draw a line to the last row of desks. Is this approximately six times the width of the screen? Under what projected image conditions might pupils sit farther away than 6W? (See Condition 2 c.)
- E. Assume you wish to project a motion picture, followed by four Polaroid slides (3 1/4-inch by 4-inch), and a filmstrip. You will use #12, #18, and #19. Now, on the same clear acetate sheet sketch the stand (emphasizing level of the top) holding #18 and #19, showing that it is low enough to prevent obstructing the light beam from #12. Also sketch the #12 stand, emphasizing its proper elevation to project a light beam over the top of #18 and #19. Mark with an "x" the place in the room to which you would move the opaque projector (assuming its stand is too high for projection from #12, #18, and #19). Mark with an "x" the temporary spot for relocating #14 also. Label "x" marks for purposes of later checking. If #14 is on a 16-inch high stand would it be likely to interfere with #13, #18, #19, or #12? How can you be sure? (Figure line-of-sight vision of pupils without obstruction.) Should the teacher be seated during projection from #14, from #13 also? From #18 and #19? (See Condition 2 d.) If the teacher is seated at a low table using projector #14, might the screen have to be tilted, that is, if keystoning were critical? See Figure 2-35. See also, for purposes of comparison, Figure 1-2 and illustrations in Chapter 5.
- F. Note that the television receiver, #21, is on a mobile stand. Could it be used insofar as observation angle is concerned in its present position? (See Condition 2 e.)
- G. Could a loudspeaker for the motion picture projector #12 be positioned in the corner, substituting it for the light box #9? Could the record player or tape recorder, #20, be moved as needed? Is it usable in the present position? Could not the flip-chart easel, #23, be relocated to provide space for student panels or work space? (See Condition 3.)
- H. Where could geographic globes on mobile stands be located in this classroom? Identify positions for display in this diagram. Could work-table space be provided for models and other observational activities by storing #6, #3, #10, #11? Television camera #22 would have to be located here if the teacher in this room were to telecast a presentation to other classrooms, or if the teacher wished to use the television-camera process to make small displays and objects visible to everyone at once. Otherwise the television camera could be moved out of the front-of-room area.
- I. With the complete resources available in this diagramed situation does it not seem possible and desirable that more pupils be accommodated? But as presentations for large groups become possible through audiovisual technology, do we not then have to make other provisions for the productive and creative nutrients of the learning activity diet?

A-V MATERIALS AND EQUIPMENT IN THE CLASSROOM



- 1-CHALKBOARDS
- 2-BULLETIN BOARDS
- 3-DIORAMA
- 4-PASSOUTS
- 5-DISPLAY CASE
- 6-ELECTRIC BOARD
- 7-FLANNEL BOARD
- 8-BOOKLETS & MANUALS
- 9-LIGHT BOX
- 10-MAGNETIC BOARD
- 11-WALL CHARTS & MAPS
- 12-MOTION PICTURE PROJECTOR
- 13-OPAQUE PROJECTOR
- 14-OVERHEAD PROJECTOR
- 15-PEG BOARD
- 16-STILL PICTURE FILE
- 17-POSTERS
- 18-3 1/4 x 4 PROJECTOR
- 19-2 x 2 PROJECTOR
- 20-SOUND RECORDERS &
PLAYBACKS
- 21-TV RECEIVER
- 22-CLOSED CIRCUIT TV
- 23-FLIP CHART

with projection media. Motion picture projectors may have built-in loudspeakers, and, if sound coverage and intelligibility seem adequate in a given learning area, and in many cases it is, teachers may be spared the effort and inconvenience of setting up special loudspeakers at the front of their rooms that are activated by projectors located elsewhere.

CONDITION 4: CORRECT ADJUSTMENT OF TONE AND VOLUME CONTROLS ON ALL SOUND EQUIPMENT UNITS. It is urgent that teachers meet the condition of establishing good sound quality. They should turn up sufficient volume to assure that pupils may hear distinctly. They should also set the tone control knob for medium to high at first and then decrease the treble emphasis downward if sibilance is annoying. Turning up the treble emphasis will generally improve distinctness and crispness of sound and hence its intelligibility.

CONDITION 5: SUITABLE PLACEMENT AND ARRANGEMENT OF MODELS, CHARTS, DIAGRAMS, POSTERS, MAPS, AND STUDY PRINTS. To meet this condition effectively teachers must decide how best to display materials that must be observed at close range and handled or manipulated. Part of this problem is scheduling pupils for required study activity. The use of tables for apparatus and models, stands for globes, stands, map rails, and rollers for maps, easels for charts, suspension wires and clips for pictures, and display cases all seem essential. Teachers should not miss the point that the educational objective determines the nature of the activity, and this in turn requires a special set of arrangements. Whenever materials are suspended or displayed on walls or bulletin boards, they should permit eye-level observation.

CONDITION 6: SATISFACTORY TIMING OF PLANNED PRESENTATIONS. Teachers who must work within the confines of a specified class period should be meticulous in their timing of audio and pictorial presentations. Teachers can know quite easily how long it takes to run off a film or a tape, and there is little need to be stopped in the middle of an interesting motion picture sequence by the bell signifying the end of the class period. All of us need to pay more attention to the timing of our classroom designs for action. In this regard all teachers can learn by observing the kind of timing that is characteristic of television programing. Whatever is said, whatever questions are asked, whatever pupil activity is required, whatever assignments and directions have to be given out, all must be subjected to a time schedule. This kind of timing is characteristic of all kinds of scripting and programing by teachers; in fact, it is a crucial element in teaching with audiovisual technology. Meeting this condition will not only eliminate teacher embarrassment and inconvenience for pupils, but it will also pay dividends in teacher efficiency throughout the whole range of his daily activity in achieving educational objectives.

Operational Skills. Control of mechanical devices can be exercised only when teachers have developed, through practice, the necessary operational skills. Although each of the devices has its own unique characteristics, all picture projectors possess similar elements such as lenses to be focused and lamps to be changed. Other kinds of devices such as record players, tape recorders, and television receivers also have common elements of construction. Such similarities make the task of developing competence in operation less difficult. Attention to the operation of instruments by teachers is given in Chapter 7, and other operational practices are described under each of the media in Chapter 5.

In some cases competence in the personal operation of devices may not be necessary. Many classrooms are today equipped with adequate darkening devices, projectors are delivered, and equipment operators are assigned through central agencies. In cases like these the teacher's responsibility for competence lies in his control of several of the previously stated *basic conditions*. There are, of course, varying degrees of audiovisual services available to teachers, from the situation where a teacher must go to the service center to pick up the projector, screen, and material and install portable darkening shades personally, to the situation where, at the scheduled time, his selected materials and equipment units are delivered, devices set up, and then activated when the signal to begin is given. The latest development is to install electronically controlled projectors in specially equipped classrooms. Teachers then push buttons to project images on rear projection screens. Obviously such installations facilitate a level of planning, timing, and programing unknown to most teachers and schools. Teachers should maintain pressure on their school administrators to take the necessary action of leadership to provide desirable modern-day instructional services.

TEACHER PERFORMANCE

Here then is a statement of the teaching performance that the *physical control principle* demands of competent teachers:

1. Operate the kinds of audiovisual equipment that are made available by school authorities.
2. Detect improper use or functioning of equipment.
3. Judge the degree of darkness needed for proper viewing of projected images for conducting any specific instructional task.
4. Arrange proper placement of screen, seats, loudspeakers, and other equipment for optimum pupil attention and participation.
5. Make proper arrangements for viewing and handling models, charts, maps, demonstration materials, and related devices.

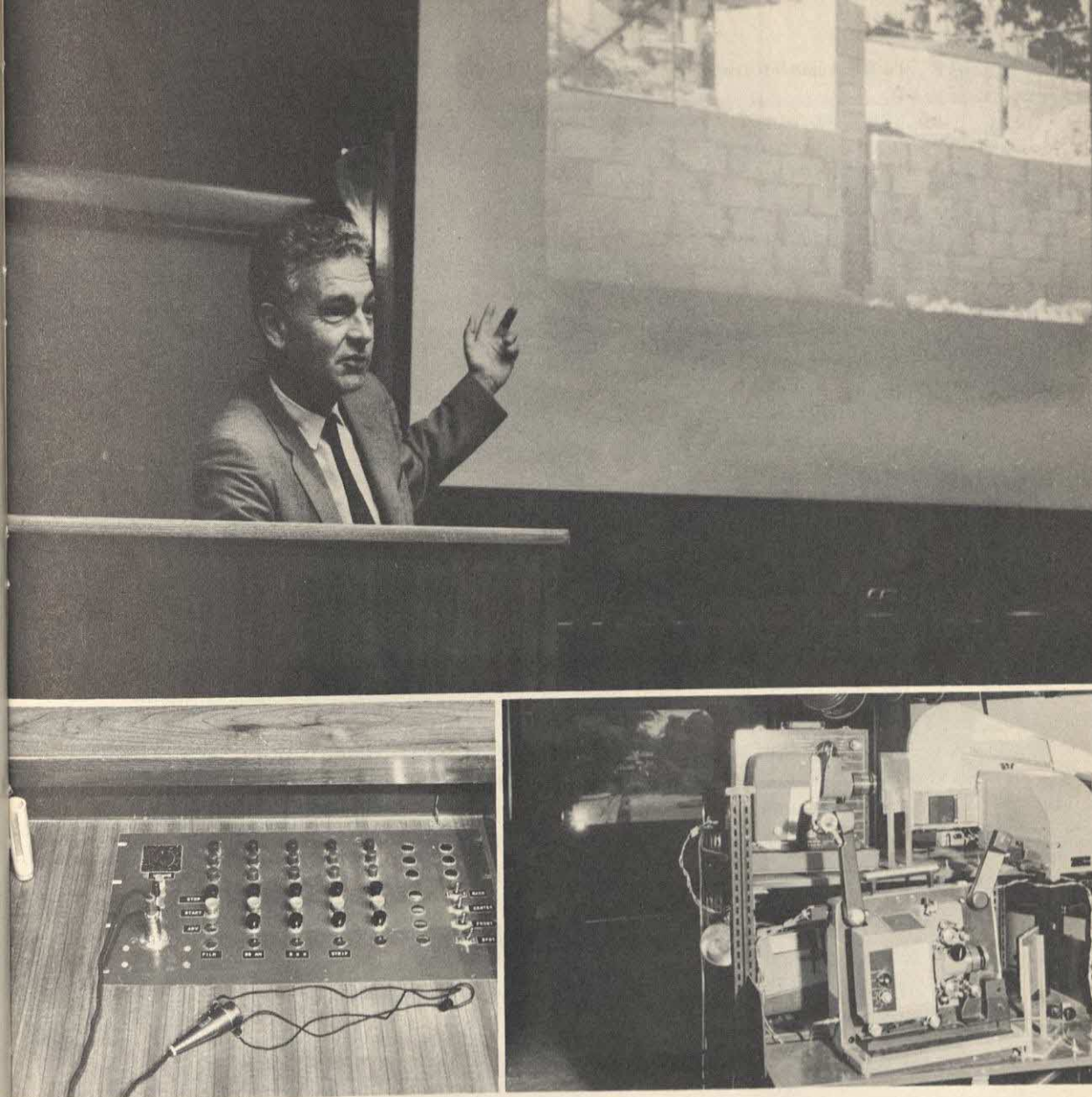


Figure 3-13. This university professor, at the University of Miami, operates several electronically controlled instruments that project their images through rear-projection screens. He makes his presentations to a group of 300 or more students. He does not have to be concerned with operational skills, but he has to be an expert in preparing visualized presentations in which all media are at his command as he pushes appropriate buttons. Note in this group of pictures the close-up view of the control panel. When these buttons are pushed, films, slides, and filmstrips are projected as needed. Lighting switches as well as a volume control for sound are also a part of the panel. Therefore many instruments, even large-screen television projectors, are ready for the instructor's commands. It is the job of technical experts to keep them adjusted and cleaned. (Courtesy Division of Communications Service, University of Miami, Coral Gables, Fla.)

6. Plan proper timing for presenting any given material to be presented in accord with objectives and existing schedules.

How to Elicit Desired Responses to Materials

The effectiveness of audiovisual materials must be judged by accomplished teacher goals, and here again it must be stated that participation is, like selection and readiness, a means and not an end. Teachers delude themselves when they blindly follow a recipe that calls for "just action, participation, discussion." Just any discussion or busy work after using audiovisual materials, interesting or beautiful as it may be, falls far short of competent performance.

Dr. Stephen M. Corey⁵ of Columbia University Teachers College once made this significant statement, ". . . the quality of instructional materials has to be determined by the reactions of the boys and girls to these materials. Whatever reactions the materials elicit, that make the youngsters feel good, describe what they are learning." This statement has many significant implications for teacher performance. If, for example, teachers intend to develop critical thinking ability as a result of a film showing, they must guide the students into such activities as appraising the data in the film or drawing a conclusion based on evidence in the film, and then investigating its applications in school or community situations. Asking "simple recall" questions in this case, even if the learners "feel good" about it, will only stimulate memoriter action and predispose students toward answering more recall questions. The teacher must always keep in mind his teaching purpose, and must plan creatively for discussion and activities that will achieve that purpose. Educators now accept "involvement, participation, and reaction" as a vital condition for learning. The use of audiovisual technology provides no exception.

THE ACTION PRINCIPLE

No teacher performance with audiovisual technology demands more professional ability than do decisions relative to teacher action *during* and *immediately after* the use of such materials.

Statement of the Principle. Stated simply, this fourth guiding principle is: *Teachers should guide the learner in the important processes of reacting to and taking appropriate action as a result of audiovisual experience situations.* An analysis of major aspects of this important guidance follows.

⁵ The topic of Dr. Corey's address on that occasion was "We Teach What They Practice."

Teacher Objectives and Determiners of Student Response. In previous discussions of the *selection* and *readiness* principles it was pointed out that having clear-cut teaching purposes (the abilities and insights, etc.) in mind was of vital importance. When eliciting desired responses of students to classroom technological materials there is no other system for teacher guidance than the valid teaching purposes identified either before or right then by the instructor. Deciding what to do or say is the creative function that every teacher must be prepared to carry out, and it should be recognized that if the film or other material was chosen to contribute to the development of a specific ability, then a practice session should follow the showing, either in or out of the classroom, either under direct teacher supervision or on a self-instruction basis. On the other hand if concepts and the comprehension of important principles are to be the products of learning, then activities involving provocative questioning, discussing, lecturing, investigating, studying, and applying in optimum balance are required. Some teachers naively elect to give the "regular lecture" and then just show a film, or some other materials, in addition. Audiovisual materials "pay off" when students learn how to do something important. Before teachers can determine what and how much student action is necessary, they must know *why*.

Learner Participation. By drawing together examples from experience and in the literature, the following significant generalization can be formulated: *Learner participation is the key to the derivation of potential values in audiovisual instructional materials.* This reaction and participation may, or should, include many forms of mental activity in depth, such as: observing, comparing, judging, memorizing, initiating, planning, questioning, searching, and generalizing in connection with significant experiences. Observing or using other devices and materials, holding discussions, making field trips, doing experiments, doing wider reading, writing TV scripts for school or community productions, writing articles for newspapers, making investigations, dramatizing, preparing exhibits, and making maps are just a few of the possibilities for learner participation that await employment by teachers with imagination.

Stress in the writer's audiovisual education classes on the importance of teaching objectives as the valid basis for determining utilization techniques has revealed a serious deficiency in many teachers. This deficiency is the inability to formulate educational objectives in terms of understandings, attitudes, appreciations, and abilities that result in changed learner behavior. In working out this problem it is further discovered that the teachers' beliefs about "what" and "how" pupils learn are at fault. Therefore, in many cases this deficiency in the overall teaching competency pattern blocks the instructor from achieving competence in the specialized area of audiovisual technology. Anyone who seeks to judge the competence

of a teacher in his use of audiovisual materials must do so by penetrating to the basic reference point, the nature and quality of his teaching purposes.

Problems and Assignments. When teachers set up problems and assignments (for completion either in or out of class) and relate their use of audiovisual technology to them directly, planning what to do or say will be easier than under any other condition. That is, there is never any doubt about what to do next, since the solution to the problem or question (not necessarily computational) needs to be checked, clarified, or advanced to the next stage of action. Some audiovisual materials like filmstrips, slides, charts, and the use of apparatus for a demonstration permit step-by-step, picture-by-picture participation. Others, like a 20-minute film that is to be projected continuously from beginning to end demand that guidance be given to direct student reaction and observation in advance, with personally led teacher-action delayed until completion of the film. Student reactions should not be left to chance, and, for guidance purposes, teachers should recognize the importance of the thought-type question. Thought-type questions in connection with audiovisual presentations may simply call for a spontaneous reaction, requiring a minimum of mental effort; or, if more complex in nature, they may demand a series of thought processes such as the recall of items of content, comparison of pupil ideas with situations in the content, and a final decision. A still more complex type of question or problem would involve planning investigation of the facts through extended study, and then generalization. The first two can probably be resolved by on-the-spot discussion, but the last type of problem or question seems to call for project work, construction, writing and field work, all involving vital functional effort.

In Chapter 4 a number of the case studies will reveal the thought-type question procedure, but a few condensed examples pending analysis of that material will facilitate the reader's understanding of this crucial aspect of guiding learners. The first example given is based on a plan for film utilization by Lillian A. Lamoreaux reported by Charles F. Hoban, Jr., in *Focus on Learning*.⁶

Example 1. Levels of thought-type questions shown by a teacher's plan to develop in youngsters the following objectives: *a sympathetic attitude toward handicapped people, a desire to overcome handicaps, habits of courtesy, and an appreciation of the faithfulness and usefulness of animals to the handicapped.* (The film used was *A Friend Indeed*.⁷ The film

⁶ Charles F. Hoban, Jr., *Focus on Learning* (Prepared for the committee on Motion Pictures in Education) (Washington, D.C.: American Council On Education, 1942), pp. 118-121. This is now out of print.

⁷ A theatrical short subject distributed by Teaching Film Custodians, New York, N.Y.

story involved a blind doctor and his seeing-eye dog. At the conclusion of the film presentation the following thought-type questions were asked to guide pupil responses along the lines dictated by the stated objectives.) Parenthetical statements are the writer's comments.

1. *Did you like the dog?* (Asked to set the tone for future deliberation. The answer called for quick, short, and spontaneous favorable response, nevertheless important.)
2. *What did you see in the picture that indicated to you that the dog was intelligent?* (Consider the complexity of thinking called for: recall what the dog did, identify own standards and ideas of intelligence and compare the dog's actions with those standards, finally judge which acts met the criterion of own standards and/or revise the standards under influence of new experience. Pupils are then ready to express themselves.)
3. *What did the dog do that people sometimes forget to do?* The youngsters said, *Think of others before yourself. Look before you cross the street. Pay attention to your business.* (Same kind of thinking and analysis is called for in this question as in the one preceding.)
4. *Can handicapped people overcome their handicap? Can handicapped people lead useful lives? If you had a friend who had a handicap and was discouraged, what would you tell him?* (Consider how the same pattern of thought processes as for the preceding questions, channel the subjective responses of youngsters toward attitudinal objectives.)
5. The teacher then spoke about the sign, "No Dogs Allowed," often seen outside of restaurants, and asked, *Do you think a blind person could take his dog in?* (This is the time for facts. Wishes and opinions cannot be accepted. Hence pupils must now plan where and how to get the facts and then draw conclusions. This is typical of assignments of a project, problem-solving class-group activity.)

In looking back at this example, an essential characteristic may be readily noted. This is the absence of simple recall as an end product. The questions do not ask for a simple enumeration of observations, a listing of events, and a recounting of what happened. Such an analysis is actually called for by the questions, but only as a part of a larger pattern of thought, of a reaction, a response, internal to the pupil, and not external residing in a film, or printed page. Yet let us not depreciate the need for reading, study, research, information, and remembering, as a part of the total teaching act. We must not fail, however, to see that thought-type questions are *based* on information, and experience with it, and they constitute a significant means for guiding the learning process. Let us now examine a second example.

Example 2. This example is a group of thought-type questions excerpted (and edited as needed) from the published motion picture film guides available from the producer of the film on which questions are based. The thought-type questions are analyzed according to levels of thinking already described.

From the film, *The Bill of Rights of the United States* ⁸

1. *What motives do some men have for denying . . . freedoms to other men?*
2. *How can we determine what is injurious to others?*
3. *Is it necessary to protect people against the tyranny of majorities as well as to protect them against the tyranny of individuals?*
4. Prepare a program for a school assembly presenting the answer to the question: How do the freedoms of Americans under the *Bill of Rights* differ from the freedoms of individuals under the tyranny in Soviet Russia? Prepare and use visual communication media.

In the first three of the preceding thought-type questions, the *Bill of Rights*, with all of its information and its dramatic episodes revealing historic events and situations, provides opportunities for recall, for the personal analysis of values and standards and comparison with local issues, and for making sound judgments and personal commitments. The fourth question becomes a class-assignment project that calls for the planning of research action, the organization of information, the preparation of program scripts and materials, all of which may lead to the culminating process of generalization.

From the film, *Williamsburg Restored* ⁹

1. *What five articles widely used in homes today would you select as best illustrating everyday life in our country?*
2. *What underlying cause of the American Revolution is illustrated in this film?*
3. *What is the nature of the basic skills that have to be used by historians in getting ready for the physical restoration, like the one at Williamsburg?*

Again as in preceding sets these questions demand responses by pupils that lead to development of insights. Such questions give opportunity to reorganize information and experience into new ideas and conclusions.

Teachers are generally able to formulate good thought-type questions

⁸ Produced by Encyclopaedia Britannica Films, Inc., Wilmette, Ill.

⁹ Produced by Colonial Williamsburg, Inc., Williamsburg, Va.

for particular class groups speedily and unerringly only when they have the guidance of valid teaching purposes.

Guidance of Action by Work Sheets. We have just discussed the importance of organizing pupil action around problem-solving activities, that is, assignments, projects, and thought-type questions. We now turn to a variant of this procedure that lends itself to self-instruction processes and to situations where the teacher wishes to maintain control by means other than word of mouth.

This procedure for exercising control and obtaining student responses is based upon teacher-prepared guide sheets. Such guide sheets may call for specific questions based on a tape, filmstrip frame, motion picture, or slide set. Such sheets may contain homework assignments, or a series of questions calling for textbook and reference study in relation to audiovisual presentations of content. Such sheets may in fact be programed sequences. They may be distributed before a tape or film showing, and then they have, in addition to value for guidance of action during or after the presentation, a *readiness-building*, motivating value as discussed under the *second principle*. It should be remembered that the nature of desirable pupil activity is determined by the teacher's purposes.

Several factors influence the teacher's decisions about the kinds and amount of pupil action called for by the guide sheet process. First is the factor of the nature of the instructional environment. In the language laboratory or at a listening-response station, students are most likely wearing headphones, and each is working alone on his material. If viewing a film in a group with or without headphones for sound, the students will likely respond silently and construct only a minimum of answers during the presentation. However, after the entire film or portion of the film has been run through, concentrated and prolonged effort may be in order. In viewing a filmstrip, either in a group or as individuals using individual viewers, students will most likely have to respond to each frame to check relationships, find causes for events, or fill in important facts for later reference. Second, students may be at work in large groups of 300 or more and they may be viewing a television program and checking an outline, filling in blanks for a series of brief questions, with summarizing action and discussion or reference study being called for at the end of the program. This method of eliciting pupil action should, of course, be a balanced portion of the diet of other individual and group project work, as will be shown by case studies in the next chapter. Since pupils need to react and take appropriate action as a result of audiovisual experience situations for maximum impact, response guide sheets are often an effective means of eliciting and controlling this action with a minimum of face-to-face, teacher-to-pupil communication.

Lecturing. Instructors who employ lecture methods predominantly

need to consider the kind of explanation that should be given during and/or following presentations involving technological materials. Shortcomings in the content need to be pointed out, and kinds of subsequent action that should be taken by students need to be described. Lecturers should above all realize, as has already been pointed out, that audiovisual materials should not play the role of an appendage. That is, the lecture content should incorporate technological materials into a new, unified whole with a new, vital, communicative impact on the student, and indeed, when this impact occurs, it will be because student mental responses and resolves have taken place.

Unique Learner Participation Through Production of Audiovisual Materials. It is often necessary for teachers to construct their own models, charts, maps, or slides, and to originate new types of demonstrations in order to "get across" difficult concepts in the teaching process. Such efforts by teachers to make their own materials is known as "production." Certain hobbyists in the teaching profession develop a high degree of expertness in making sound or silent motion pictures, slides, and the more complicated models and exhibits.

As an example of these special efforts, a teacher in one of the author's audiovisual education classes made an unusual contribution by displaying



Figure 3-14. This fifth-grade group produced a filmstrip for a special Memorial Day program in the school's auditorium. Pictorial and graphic panels were made up by the class and then photographed two at a time, as shown, by a 35mm camera. The resulting filmstrip could be projected on a standard single-frame filmstrip projector. The class also prepared a commentary for each filmstrip frame. (Courtesy Board of Education, New Britain, Conn.)

a swarm of honeybees in a glass hive. She explained how her husband had made the device to help her teach a fifth-grade science unit. Her competence is well marked by her imagination and her willingness to try a novel experience.

In recent years, however, increasing attention has been given to the production of communicative materials as purposeful pupil-learning experiences. Such pupil-teacher experiences as making slides, making recordings, writing and producing radio programs, making models, maps, filmstrips, making and displaying collections of museum material, and constructing dioramas and producing motion pictures may constitute the core of purpose so necessary for the "experience unit" of the modern school curriculum. The value in such activities is obvious when consideration is given to the wide range of mental, social, and physical experiences demanded for completion. The process of "production" is, then, a unique method for using certain types of audiovisual material and a unique way of guiding reaction and participation in terms of the teacher's purposes,

Figure 3-15. This group of high school students, together with their teacher, is using an 8mm motion picture camera to produce a short film about projection lamps. Note simplicity of equipment in the pictures. (*Courtesy Hamburg Schools, District #1, Hamburg, N.Y.*)



while pupils work as a production crew on a significant problem that they have accepted as their own.

Such a teaching task cannot be readily accepted or carried out by a teacher who is thoroughly subject-matter centered. Such a task is for the teacher who is both a co-worker and supervisor with equal responsibility for problem-solving activity. Such a task is undertaken only by those teachers who are themselves willing to undertake investigation and the development of knowledge and abilities not previously possessed.

In organizing and carrying out such joint pupil-teacher production as the hub of adventurous learning, teachers are cautioned to bear in mind that:

1. The major criterion of success will not be the finished television program, tape, slide set, or motion picture, but the degree to which new concepts and abilities have been learned and attitudes and appreciations have been acquired or deepened.
2. The major pitfall to be avoided for the teacher is to get lost with the

Figure 3-16. This group of ninth-grade students prepared and produced a television program about science over KNXT-TV, Los Angeles. The program was telecast live. (Courtesy Los Angeles City School Districts, Los Angeles, Calif.)



students in the details of picture shooting and recording, for example, and thus lose sight of the educational objectives to be reached. Student research and critical evaluation of the subject matter to be included in the final production are the pathways to avoid this.

3. Pupils seem to be challenged by production problems. They lose themselves in the maze of activity, pouring forth energy in boundless amount. They like the lifelikeness of the physical and mental activity in a virile combination. Thus it would appear that attitudinal goals may be well served by such unique learning activities. One junior high school student, who was the film director for a 400-foot sound motion picture in a junior high school science class, said in answer to a question, "Yes, I directed the film. It was the most important thing I ever did in my life."

TEACHER PERFORMANCE

Here then is a statement of the teaching performance that the *action principle* demands of competent teachers:

1. Identify and call for pupil action in direct relationship to specific teaching purposes.
2. Formulate and use valid, provocative, and illuminating thought-type questions.
3. Employ good discussion techniques based on known and accepted problems, topics, and issues.
4. Organize pupil action around imaginative, challenging, and unique problem-solving project work.
5. Prepare work sheets calling for specific programed responses in the light of (a) objectives, (b) a given audiovisual presentation, and (c) a given instructional environment; or employ commercially prepared programed sequences as available.
6. Organize action of learners around the production of audiovisual materials as significant, class-group learning activities (producing a sound film, set of slides, or making a mural).

The important processes for eliciting responses of pupils just described have been related to the use of technological materials. They are basic teaching processes, and they are basic to the use of all teaching materials, printed, televised instruction, audio, visual, and automatic machines. Guidance of learning activity is what teaching is, and what is being said is that teachers everywhere must give more attention to the determination of their objectives because these determine what teachers need to do and

say, what pupils need to do, and what materials need to be procured and put to work in the process.

How to Appraise Audiovisual Methods

THE APPRAISAL PRINCIPLE

There is still another aspect of teacher performance that must be brought into sharp focus, namely, that of critical appraisal.

Statement of the Principle. This fifth guiding principle is as follows: *Teachers should subject both the audiovisual material and the accompanying techniques to continual evaluation.* An analysis of teacher performance in applying this principle follows.

Basis of Value. Audiovisual technological materials have no "magic" in themselves. Their values are rich potentials to be released by teachers through the manipulation of teaching-learning situations. Their values can be recognized only in the results of their use. Projecting a picture on a screen or placing a model of a hydraulic mechanism on a table in front of a group of students provides no assurance that learners will draw the best conclusions or change their behavior in desirable ways. It is the crucial linkage of audiovisual materials between *teaching purpose* and pupil accomplishment that determines their value. Implicit in the discussion of each of the previously discussed aspects of the utilization process was the factor of teacher judgment. Did the judgments relative to the selection of a particular kind of material, to the means designed to develop interest and needs, and to the techniques devised to elicit reaction and participation bring about the realization of planned achievement? To be competent in this area of evaluation each teacher must seek and find the answer to that question. Without this process of self-criticism the teacher cannot discover wherein strengths or weaknesses in methods lie, and the road to improvement remains barricaded.

Appraisal of Materials. If a particular kind of instructional material has been properly selected before inclusion in teaching plans, it has already been subjected to a careful appraisal for high quality, purposes, and characteristics of a specific group. Evaluation after or during use, however, demands a satisfactory check on the original judgments. Such questions as the following need to be kept in mind and answered by the teacher:

1. What did students like about the content of the material I used?
2. Did students react to the content the way I hoped they would?
3. Was the material too trivial or superficial for the characteristics of my group?

4. Was the material actually worth the time and effort, or should I locate another type of material?
5. Did the content of the materials help me to release the energies of my pupils?

There is no rule of thumb by which a teacher can develop an unerring procedure for selecting just the right materials for use at precisely the right time. Continual scrutiny of the materials used in terms of observed student responses in specific situations offers the most rewarding means of improving judgment.

Appraisal of Techniques. The second of the two points of departure for the teacher's evaluation is his appraisal of his own plan of procedure. The basic task in carrying out the appraisal of techniques utilized is the determination of the degree to which these procedures achieved the desired results. Before actual use, the plan for building readiness and the plan for reaction and participation are, or should be, the best possible judgments in advance as to what will work. The results of the plan need to be scrutinized. Where procedures do not produce the desired results in learners the teacher must find out why. Such guiding questions as the following will be helpful:

1. Was the class problem, or the assignment, significant, appealing, and functional?
2. Did I misjudge the readiness of the group?
3. Were my thought-type questions poorly phrased for the kind of mental action I needed to obtain?
4. Did the activities resulting from my use of the material lack challenge and significance?
5. Are my purposes valid?
6. Were circumstances beyond my control at fault?
7. Are the sources of my evidence (pupil responses) for appraisal valid?

Teachers may find that calling upon students directly to assist in evaluating materials and methods is also a fruitful way of identifying strengths and weaknesses.

TEACHER PERFORMANCE

Here then is a statement of the teaching performance that the appraisal principle demands of competent teachers:

1. Engage in the process of self-criticism and be willing to modify previous plans of action.

2. Judge the worth of audiovisual materials in terms of specific learning objectives.
3. Scrutinize the teacher's own procedures in the light of pupil growth and valid principles of learning.
4. Make use of various sources of data in making judgments of strengths or weaknesses in materials and methods.

Problem-Solving Activities

1. In the light of the concepts presented in this chapter, write out a succinct statement in not more than a paragraph explaining why the application of the five principles to the use of a motion picture may constitute a creative design.
2. Identify the three crucial elements in the *selection principle*. Then carry out the following activity:
 - (a) Find a reasonably comprehensive set of teaching purposes (objectives) in a curriculum guide or resource unit for your teaching field and grade, or turn to one or more of the specific examples in Chapter 4, and then use any catalog available to select several titles of filmstrips and films that might help you achieve those objectives.
 - (b) Arrange at your school's resource center to examine several filmstrips and/or motion pictures to ascertain differences in production quality or examine one or more examples of material projected for the whole class to analyze. Name several specific aspects of high quality in audiovisual materials.
 - (c) Make a list of some of the unique characteristics of a group of pupils that you might be teaching in the future that would influence your selection of a given kind of instructional material.
3. What is the difference between teacher and pupil purposes? Give *several examples*. What is the relationship between teacher purposes and pupil reactions and participation as a result of audiovisual materials? Why are *teacher purposes important? For use of books? For use of teaching in general? For use of audiovisual technological materials?*
4. Examine the following bases for selecting audiovisual technological materials:
 - (a) A subject-matter topic in a book.
 - (b) A teaching unit topic.
 - (c) A chapter heading in a book.
 - (d) To avoid the pressure of work, or keep pupils busy.
 - (e) To entertain youngsters and give them a respite.
 - (f) Because another teacher has the material at hand.
 - (g) Because the principal and/or audiovisual coordinator picked it (the film or filmstrip) out.

- (h) Because the material would provide experience and supply information for a specific problem the pupils are working on, that is, to serve *pupil purposes*.
- (i) To help teachers accomplish their own valid teaching purposes.

Now answer these questions:

- (a) Which ones are perhaps actually unprofessional?
 - (b) Should a good pupil problem be related to valid teacher's purposes in professional ways? Is it not right to say that the last two bases in the preceding list then constitute the proper basis for selection? Would it be possible for a teacher to have the ability to set up good problems without having valid purposes in mind to the detriment of pupils?
 - (c) If a teacher consistently used the first three as bases, what could probably be said about the breadth of his or her objectives? Would the teacher be likely to be concerned with explanation of logically arranged subject matter? In a highly specialized course is rote memory and mastery of logically presented subject matter required? What is the value of organizing subject matter around pupil problems?
5. Go to your curriculum resource center and consult media sourcebooks and school-system catalogs, and with a specific teaching task, topic, or set of objectives as a heading on your paper, make lists of available materials by media and specific title.
 6. Explain why having a vital pupil problem is perhaps the best way to develop readiness in pupils to read leaflets and books, to search for materials in libraries, and to look at films, pictures, charts, and television programs. Make a list of some other good techniques for developing readiness to participate actively in audiovisual experience situations.
 7. How can students themselves be worked into the center of *readiness building* activity before presenting or using technological teaching media? Presenting problem situations? Introducing films and other media after previewing them? Pupil panels?
 8. One still hears an old promotional slogan, "Bring the world into the classroom." Is it not vastly more appealing to pupils who look at their own home environment every day to be invited to travel pictorially to the arctic, to the jungle, to Mt. Everest, to the Great Coral Reef, and even to skid row, for some observations? The *magic carpet* role of technological materials is valuable. List a few valuable "film" journeys you would suggest for your future use.
 9. Make a sketch of any classroom with which you are familiar through day-to-day use showing where you would locate a motion picture projector, screen, and pupils. Locate in the same sketch a television receiver, an overhead projector, and an opaque projector. Also find out if you could use a filmstrip projector with a 5-inch focal length lens, and a lantern-slide projector with a 12-inch lens from approximately the same place as a motion picture projector with a 2-inch lens?
 10. Name four or five models and/or objects that you wish to display for

observation and handling by pupils in your future classes. Explain with a labeled sketch how you would establish *Condition 6* under the third guiding principle.

11. Write up or tell your classmates in a few words an actual case where poor timing and teacher planning for a film showing or some other activity, by one of your former teachers, had a deleterious effect on pupil attitudes and on pupil-teacher relations in general.
12. What is all this emphasis on problem solving? Is it not difficult enough for the pupil to learn the subject matter? What does the breadth of teaching objectives (the abilities, insights, commitments to action) have to do with such narrow concepts of teaching? With the intrinsic, significant, challenging problem-solving process?
13. If problems, questions, and projects are not set up before the use of, for example, a film or transparency should they be set up afterward? Where does functional use of the subject matter enter into pupil performance? Into pupil productive creativity?
14. Can you state succinctly what the relationship is between a teacher purpose and student response, or should be? Give several specific examples. (Think about the word *determine*. Does a teacher's purpose narrow the field of required responses?)
15. Does a good problem on which pupils can work call forth desired responses? Can you give several examples in your field of teaching? State four valid teaching purposes in the nature of abilities and then show one good problem by which the pupils would develop the specified objectives.
16. What makes a good problem? Here is a partial list of attributes of good projects, problems, questions, and activities on which pupils can work. Use these attributes as yardsticks for being critical of your own decisions. Problems should be:
 - (a) Related to out-of-school interests and activities.
 - (b) Related to extracurricular activities in school.
 - (c) Related to home and community environment.
 - (d) Stated clearly and crisply, not interspersed with places, materials, processes, and organization. (All this follows in the subsequent class organization for action.)
 - (e) Stated in the following form: Find out how ____; Construct a corridor display to ____; Write an article for ____; Write and produce a television program on ____; Conduct a survey and ____; Evaluate the leadership of ____; Write, rehearse, and record a play on tape depicting ____; Make a mural, a set of slides, a film strip, a diorama, a set of models, and a series of posters to explain ____; Write and produce a play on ____; Make a scrapbook for the library about ____; and so on.
 - (f) Important to the student, functional and lifelike.
 - (g) Can be accomplished with reasonable time and effort.
 - (h) Appealing and challenging to the student.

- (i) Formulated to elicit the kind of behavior and practice that objectives demand.
- (j) Balanced for academic and functional impact.
- (k) Varied in nature with many approaches to meaning.
- (l) Formulated to demand optimum amount of both individual effort and work by a group.
- (m) Set up to demand optimum amount of pupil-teacher planning.
- (n) Worded so as to refer to pupils themselves.

As you make progress in your ability to originate good teaching plans keep checking your learning activities against these criteria. *Right now, in the light of your future teaching, write down a few outstanding examples of good pupil problems and hand them in for evaluation.*

17. Many teachers claim that a class activity is not a problem. *Only questions are problems*, they say. Is not the planning and construction of a model or a mural, or the writing of a report or an article, or the making of a set of slides a problem? Should not some reading and study be done for purposes of mastery? Should an optimum amount of reading and study be done because vital information is being sought for problem-solving processes? How can emphasis be given to outside or in-class study and reading? Should pupils submit a daily or weekly record? Tests and quizzes? Oral reports? Log of readings compiled in notebooks?
18. How can films, television programs, filmstrips, charts, slides, maps, tapes, and the like be related to problem-solving activities of learners? Explain this by using specific examples pointing out *before* and *after* relationships, as well as *ready-made* materials and *pupil-teacher produced* materials.
19. What is or should be the basic reference point for all evaluation activity, in short, the basis for judging value and/or progress? Must not both the material itself and the teacher techniques be judged in terms of this *teaching purpose* basis?
20. Scrutinize the quotation in Chapter 2 stating Hoban's and Van Ormer's film principles included under the heading of *The Medium of Motion Pictures* and give a specific example of how each of those principles could influence your decisions for pupil action when using a motion picture. Explain also how Hoban's and Van Ormer's principles 6 and 7 apply to your creation of a readiness plan for a motion picture for one of your future classes.
21. In connection with controversial materials, what utilization conditions will you seek to develop? Community-school relationships? Principal-teacher relationships? Common-sense and "good-taste" procedures? Adherence to basic principles?
22. The joint teacher-pupil production of slide or picture sets, corridor or store window exhibits and displays, radio or audio programs on tape, and film or television programs offer exciting and absorbing possibilities for

- learning activities. *Make a list of specific titles for such possible productions in your teaching field* and point out in two or three sentences how such a production would be used upon completion.
23. If a pupil is willing to work on a vital problem, alone or with a group, is it likely he will be interested? How do you define interest?
 24. Consult a special reference such as the *NSSE Forty-Ninth Yearbook*, Part One, 1950, pp. 69-215, and find out how youngsters learn or develop understandings, attitudes, appreciations, and abilities.
 25. Where should a loudspeaker be placed for optimum listening? How do tone control settings affect the intelligibility of sound? Explain a convenient way to place the loudspeaker at the rear of the room near the projector.
 26. How can the desired picture size be determined for any room?

Available Technological Materials for Class Use

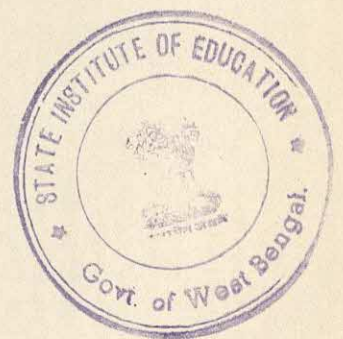
- And No Bells Ring*. 16mm motion picture. NEA (Dept. of SS Principals). B & W. 57 min. (in two parts). (Use to study applications of audiovisual technology to new use of teacher talents and pupil responsibility.)
- Children Learn From Filmstrips*. 16mm motion picture. McGraw-Hill (National Film Board of Canada). B & W or color. 16 min. (Use to evaluate the application of the five principles when using the filmstrip medium.)
- Choosing a Classroom Film*. 16mm motion picture. McGraw-Hill. B & W or color. 18 min. (Use to identify valid bases for choice. Evaluate them in the light of the *first guiding principle*, in Chapter 3.)
- Effectiveness of Audio-Visual Materials*. Filmstrip, 45 frames, color. Basic Skill Films. (Use to present some basic research findings. Identify and emphasize translation of research conclusions into teacher action. Stress the five basic principles in relation to the research findings.)
- Film and You (Using the Classroom Film)*. 16mm motion picture. Bailey Films. B & W or color. 13 min. (Use to illustrate operations in an elementary school classroom.)
- Fundamental Skills in a Unit of Work*. 16mm motion picture. Bailey Films. B & W or color. 21 min. (Use as a means of evaluating teaching practices with technological materials, using the five basic principles as yardsticks.)
- How to Make and Use a Diorama*. 16mm motion picture. McGraw-Hill (Syracuse University). Color. 20 min. (Use last portion of film as a complete example of a class production problem.)
- How to Use Classroom Films*. 16mm motion picture. McGraw-Hill. B & W or color. 15 min. (To find out if illustrations of teacher decisions are creative and if they follow the dictates of the five basic utilization principles.)
- Photographic Slides for Instruction*. 16mm motion picture. Indiana University. B & W or color. 10 min. (Use to stress the need for teachers to prepare their own technological materials.)

- Selecting and Using Ready-Made Materials.* 16mm motion picture. McGraw-Hill. B & W or color. 17 min. (Use to identify application of five basic principles in each teaching situation shown.)
- Using Maps and Globes.* Filmstrip, 48 frames, color. Rand McNally. (Use to discuss the application of five basic principles to the use of this graphic symbol medium.)

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4

EXAMPLES OF AUDIOVISUAL TECHNOLOGY AT WORK

We can assert, even at the risk of oversimplification, that the first and most important professional act of the teacher is to identify valid teaching purposes, that is, the educational objectives that are directly influential and operative as guiding beacons in the day-to-day classroom activities. It has been emphasized previously that these purposes of the teacher are or should be the understandings, abilities, attitudes, and appreciations operating as determinants of behavior in the lives of the learners. Then, as a consequence, we can further assert that the second logical and inescapable act of the teacher is to identify, originate, or guide students in originating and accepting the kind of learning experiences by which the purposes will be achieved. That is, in which the crucial performance (desirable abilities) will be practiced, where observations will be made, conclusions drawn, where references, both pictorial and verbal, will be studied and appraised, and where technological devices, manually operated or automated, will be employed as a source of information and/or stimulators of response.

At this point and for the purposes of this book, we need only mention the third profoundly professional act, namely, the evaluative process, as the next "wide and royal" road to teaching competence. However, we need to point out that even in this area good teachers use a variety of technological materials such as pictures, maps, films, and diagrams that may serve as stimulators, or as the reference base in formal testing.

The common condition that is pointed out here is that many teachers still place implicit faith in the printed word. They orient all their teaching around a textbook to be learned, emphasizing memory. This performance is certainly not far from the methods used in the middle ages. The beginning teacher must be aware that experienced teachers, who should know better, sometimes develop the ability to keep pupils busy on interesting activities, busy on anything, that is, a steady stream of activity. Such teachers become expert organizers and develop undeserved, excellent reputations, and often undeserved commendation is awarded them. Actually, because such teachers lack insight, and in fact have not identified their teaching purposes, they cannot possibly guide their students to crucial mental and physical activity. It is easy, in the absence of valid teacher purposes, to involve pupils in the construction of a school corridor display and yet miss the increment in *communicative ability*, the understanding that impactful words and pictorial illustrations may serve as powerful influences on the actions of people, the ability to *evaluate judgments of people*, the addition of an increment to the desirable attitude of criticalness, or miss the development of the appreciation of *effective planning*.

We therefore emphasize again in this chapter the importance of the formulation of valid teaching purposes as a basis for all teaching activities in general and for the selection and use of audiovisual technology specifically. Because of the impact of this ability on teaching performance, the

first part of this chapter is devoted to the nature and formulation of teaching purposes.

Stating Teaching Purposes

One of the difficulties in solving the problem of identifying educational objectives is the need to decide which level is appropriate for optimum guidance of classroom action. Broadly stated objectives, based on sound philosophical and psychological considerations, are certainly of value, but the teacher is always faced with implementation. He must develop means to achieve ends that are, and have to be, relatively close at hand to the present needs of youngsters. This is why teachers must perceive teaching objectives in the light of a teaching unit, in the light of present-day needs. Unless the educational *objective* (the teacher's purpose) is stated at the specific behavior-pattern level of the pupil in any given course, or curriculum, for any given problem or teaching unit, the teacher will get little, if any, guidance from it for practical day-to-day performance. Such a valid objective helps a teacher decide what problem, what book, what film, and what guidance will be suitable. Without such a good objective or system of objectives, teachers will proceed according to whim and expediency. What, then, are some basic characteristics of useful teaching objectives?

CHARACTERISTICS OF USEFUL OBJECTIVES

We have repeatedly used the terms in describing objectives that have been widely used in other textbooks on the subject, for example, by William H. Burton¹ namely, *understandings, abilities, attitudes, and appreciations*. Actually such a classification would be dangerous if readers received the erroneous impression that each type of objective named was taught and achieved separately. The exact opposite is true. All are interwoven and enmeshed in a complex of mental action. The development of any given physical performance by a learner calls for understanding as well as refinement of physical adjustment, together with the outgrowth of changes in mental set, a commitment to action, and a tendency to choose certain things, processes, and behaviors. Teachers must therefore be aware of the complexity of the nature of learning products, the outcome of teaching activity.

¹ William H. Burton, *Guidance of Learning Activities* (3rd ed.; New York: Appleton-Century-Crofts, Inc., 1962), pp. 348-353.

The following list of characteristics is presented as a basis for study and discussion, and as the basis for guidance of both preservice and in-service teachers in their efforts to state valid objectives:

CHARACTERISTICS OF TEACHING PURPOSES

UNDERSTANDINGS:

1. Are the generalizations, beliefs, conclusions, insights, ideas, concepts, definitions, principles, statements of fact (when related to broader concepts and abilities), and directions for procedure we want our students to develop, learn, know, acquire, draw, or comprehend.
2. Should be expanded enough in structure to convey clear meaning. (For instance, state why a process is important.)
3. Should be stated by teacher in language likely to be used by students in their responses to situations involving the concepts.
4. Should grow from student problem-solving experiences.
5. Should be declarative in nature, and the statements should be preceded by *understanding that*, as a safeguard against inconsistency and incompleteness.

ABILITIES:

1. Are the kinds of performance students are to be taught in any given course or unit of work, in general, to be carried on in life after the course is finished. Abilities may be taught directly or may be an incidental product of class action.
2. May be stated briefly and are most often accompanied by qualifications of degree of desired efficiency. Teachers derive more help from statements of purpose when an item contains only one ability. Therefore two or three abilities should not be combined.
3. May be stated in considerable breadth and then broken down into subsidiary abilities if deemed advisable.
4. Must be thought of as growing from, not identical with, the specific learning activities. (Problem-solving work.)
5. Should be preceded by the words *Ability to*, as a safeguard against inconsistency. All extra words such as *to develop in students the* should be avoided. Abilities are frequently stated as *Ability to know*, *Ability to learn*, etc. Such expressions refer to learning capacity and are not correct.

ATTITUDES:

1. Are statements describing relatively stable mental sets, stable patterns of conduct, pervasive action at home, play, and work.
2. Should be kept brief, one word if possible. It may help to characterize descriptive terms by an ending of *ness*, like *cooperativeness*, and *considerateness*, etc. Some descriptive terms for well-known attitudes like *inquiry* and *patience* do not lend themselves to the *ness* ending. In these

cases precede the word or words by *Desire to* or *Willingness to*, otherwise let it remain *attitude of patience*, for example.

3. Should be so stated that pervasive application is obvious.
4. Should be stated one at a time in the list for maximum emphasis.
5. Precede descriptive terms by *Attitude of*, as a safeguard against inconsistency.

APPRECIATIONS:

1. Are the things, processes, actions, and characteristics that it would be desirable for students to like and choose.
2. Should be listed one at a time for maximum clarity of purpose.
3. Should not include such expressions as: *value of*, *contributions of*, *importance of*, *need of*, *role of*, etc. Such statements, if spelled out, are understandings, hence should be included where they belong. Apply the test of *choice*. An individual understands or comprehends the *role of* air transportation in our economy, but he does not choose the role. He likes and will choose air travel as a process or he does not and will not choose it.
4. Should be stated briefly and specifically. Behavior characteristics provide a good beginning for teachers.
5. Should be preceded by *Appreciation of*, as a safeguard against inconsistency.

SAMPLES OF PURPOSES

After examining the criteria for stating purposes, we should now look at an edited statement of purposes made by a teacher² in connection with the showing of a film titled *Pioneer of the Plains*,³ part of a teaching unit on the *Westward Movement*. In this case the film was used as a "magic carpet," that is, a realistic trip into the early West accompanying some pioneers, basically, as a springboard into a unit of work. The teacher had made a mimeographed trip guide as a readiness device for the students, and had made plans for discussion and work on significant problem activity for a number of class periods after the film showing to accomplish the objectives stated.

This statement of objectives is offered for purposes of evaluation. How well do the statements in each category meet the criteria? The statement follows:

SAMPLE 1

UNDERSTANDING THAT:

1. A pioneer is one of the first to explore the unknown, to prepare the way for others.

² Shirley M. Titus, West Hartford, Connecticut Schools.

³ Encyclopaedia Britannica Films, Inc., Wilmette, Illinois.



Figure 4-1. These still pictures from the film, *Pioneers of the Plains*, reveal the nature of its potential to afford pupils the opportunity to make observations. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)

2. The pioneer and the spirit of the pioneer have been a vital force throughout the history of mankind. Columbus, Pasteur, the crew of the Nautilus, and the astronauts are examples of pioneers.
3. The pioneer has made an invaluable contribution to the growth and development of the United States by settling new territories, meeting the challenge of a new environment, and transmitting this knowledge to those who followed him.
4. The pioneer gave new zest to the spirit of democracy in the United States.
5. There were many dangers and hardships confronting the pioneer. He struggled against nature, other men, and his own personal weaknesses.
6. Geography and climate are important in determining the social and economic life of people. In the plains region, one cannot earn his living by being a fisherman. The loneliness of the plains made one appreciate his neighbors.
7. The sod hut was usually the first kind of home which a pioneer family of the plains had.
8. The seasons of the year are often important in determining the activities of man.
9. Many of the problems encountered by the pioneer are the same kinds of problems that people of all ages have met.
10. Men venture into the unknown for many reasons including a desire for wealth, a desire for fame, a desire for freedom, a desire to spread religion, and a desire to seek adventure.

ABILITY TO:

1. Cooperate with others to achieve a common goal.
2. Use the research method.
3. Communicate ideas effectively.

ATTITUDE OF:

1. Desire to explore the unknown.
2. Helpfulness.
3. Perseverance.
4. Criticalness.

APPRECIATION OF:

1. Courageous acts.
2. Cooperation with others.
3. Original thinking.
4. Challenging problems.
5. Good planning.

In pursuing the analysis of the set of purposes in Sample 1, the reader is urged to answer the following questions or make the suggested judgments:

1. How should the understandings in the list be taught to the learner?

Memorized as such? Concluded after observation, and based on data?
Concluded as a result of problem-solving activity?

2. Identify in the list a definition and a broad generalization.
3. Are the statements sufficiently long to be clear in meaning? Are they couched in language pupils would use themselves in writing or answering an examination question or making a report?
4. Expand understanding number 4. Also expand number 7. Make the meaning clear.
5. What kinds of practice are implied in the stated abilities?
6. How would challenging and interesting problems help to develop some of the attitudes and appreciations?
7. Are the attitudes pervasive enough?
8. Are the appreciations specific? Which appreciation does not describe a behavior? Should a pupil like and choose problem-solving activity?
9. What vital facts, if any, have been omitted from the list of understandings?
10. Jot down a few acceptable additions to each category in the statement of objectives, being sure to judge them in the light of the stated criteria.
11. Do you understand that the set of purposes here itemized was a part of a larger set of objectives for the whole teaching unit on the *Westward Movement*? Are not the objectives here stated those that the film and its related activities would help accomplish?

Now let us turn to another statement of specific objectives by a physical education teacher⁴ that provides an opportunity for study of understandings that are directly related to a series of abilities, where the abilities would be taught directly through both physical and mental activity. In this instance the teacher was planning the use of the film *Volleyball Techniques for Girls*.⁵ After introductory activity and screening, the class would engage in practical and developmental activity, and then be organized into teams for a "ladder" tournament and an intramural program. The statement is as follows:

SAMPLE 2

UNDERSTANDING THAT:

1. Volleyball is a team sport and is best played through cooperation and teamwork with other team members.

⁴ By permission of Janet L. Arnold, Willimantic, Connecticut Schools.

⁵ Coronet Films, Chicago, Illinois.

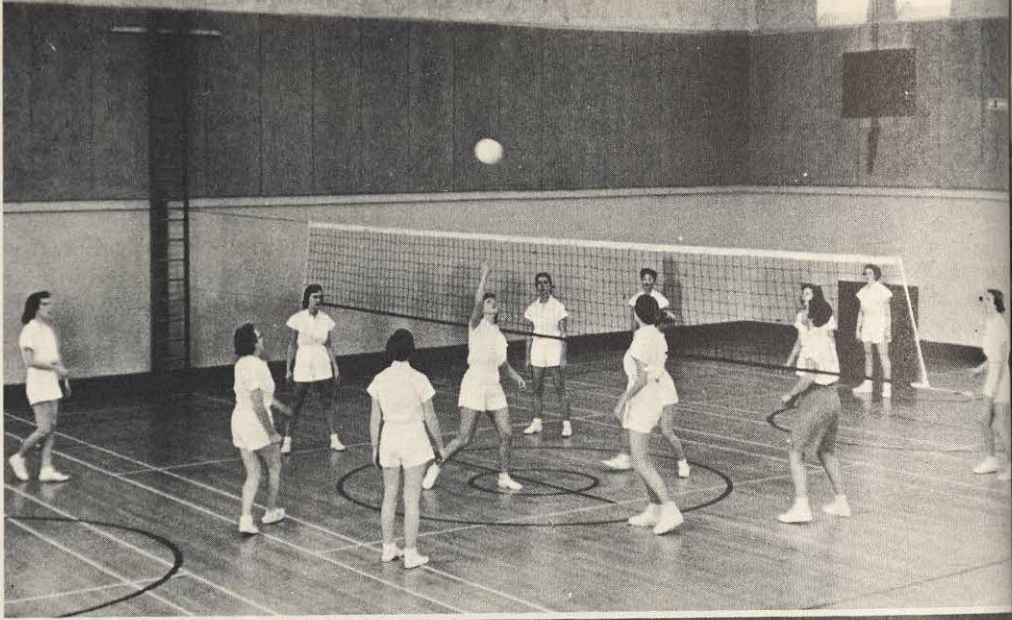


Figure 4-2. Pictures revealing the nature of content in the film, *Volleyball for Girls*, indicate the power of motion pictures to give directions for action, and, through stimulation of appropriate pupil responses, to contribute to development of desirable attitudes and appreciations. (Courtesy McGraw-Hill Book Company, Text-Film Department, New York, N.Y.)

2. Good playing can only be achieved through the practice and utilization of basic skills.
3. To keep from holding the ball, only the fingertips should be used.
4. A vigorous arm extension and snapping of the wrist are necessary to give the ball proper direction.
5. The best way to gain control of a poor pass is to do a set-up to yourself.
6. The best defense for a spike is a block or underhand volley.
7. Players should watch the ball at all times and be in a good position to receive a pass.
8. The volleyball service is very important, as only the team which is serving can score points.
9. To perform a spike, the spiker must be able to leap high enough so that her hand is above the ball.

ABILITY TO:

Participate effectively in a game of volleyball, specifically to:

1. Serve.
2. Pass accurately.
3. Perform a spike.
4. Work with other team members.
5. Play own position.

ATTITUDE OF:

1. Cooperativeness.
2. Alertness.
3. Criticalness.
4. Perseverance.

APPRECIATION OF:

1. Good timing sense.
2. Good body control.
3. Good sportsmanship.
4. Vigorous physical activity.

Again as before evaluate the specific statements in the preceding list to find out if they are stated in consistent form, and if they satisfy the criteria. Answer the following questions or carry out the suggested operations:

1. Check the characteristics of teaching purposes section, item 1, under understandings and determine what is the nature of the understandings stated in the list of objectives. That is, how are the understandings related to the abilities?
2. Why are the attitudes and appreciations in this list appropriate?
3. Explain why the attitude of *perseverance* is valid for both fields of

pupil activity, in the list for *Sample 1* as well as for the list for *Sample 2*.

4. Do you know anyone who lacks good body control? Good sportsmanship? Who abhors vigorous physical activity?
5. What do you believe the tournament and intramural participation organized by the teacher have to do with the objectives as stated?
6. Jot down at least one of your own teaching purposes of each type, real or hypothetical, for your own teaching field, and check them against the list of characteristics.
7. Should not purposes like those stated by the teacher have been already formulated in the *Course of Study* for the physical education program? If they had been would teacher planning be easier?

In still another example we see the efforts of a primary grade teacher⁶ to identify valid teaching purposes. In this instance the teacher used the film *Baby Animals*.⁷ She preceded the screening with a discussion about past pupil experiences, raised a series of questions to guide observation of action in the film, and afterward set up a pet-care check list in a bulletin board display, organized a cat and kittens in-class observation project that led to a language chart reading activity. The statement of teaching purposes (objectives) follows:

SAMPLE 3

UNDERSTANDING THAT:

1. Some very young animals are different than their parents in appearance.
2. Many baby animals are helpless and require the care and training of their parents.
 - (a) Some animals teach their young to swim, fly, climb, etc.
 - (b) Some animals teach their young to be cautious, and protect them from danger.
 - (c) Some animals teach their young to find food.
3. The food requirements vary for young animals.
 - (a) Some animals eat food similar to that of their parents.
 - (b) Some young animals require milk.
4. Different kinds of animals carry on different kinds of activity.
5. Different kinds of animals require different types of care.

ABILITY TO:

1. Read.
2. Make simple generalizations.

⁶ By permission of Elizabeth G. Banks, Groton, Connecticut Schools. This statement also appeared in the author's earlier book, *Administering Audio-Visual Services* (New York: The Macmillan Company, 1959), p. 67.

⁷ McGraw-Hill Company, Text Film Department, New York, N.Y.

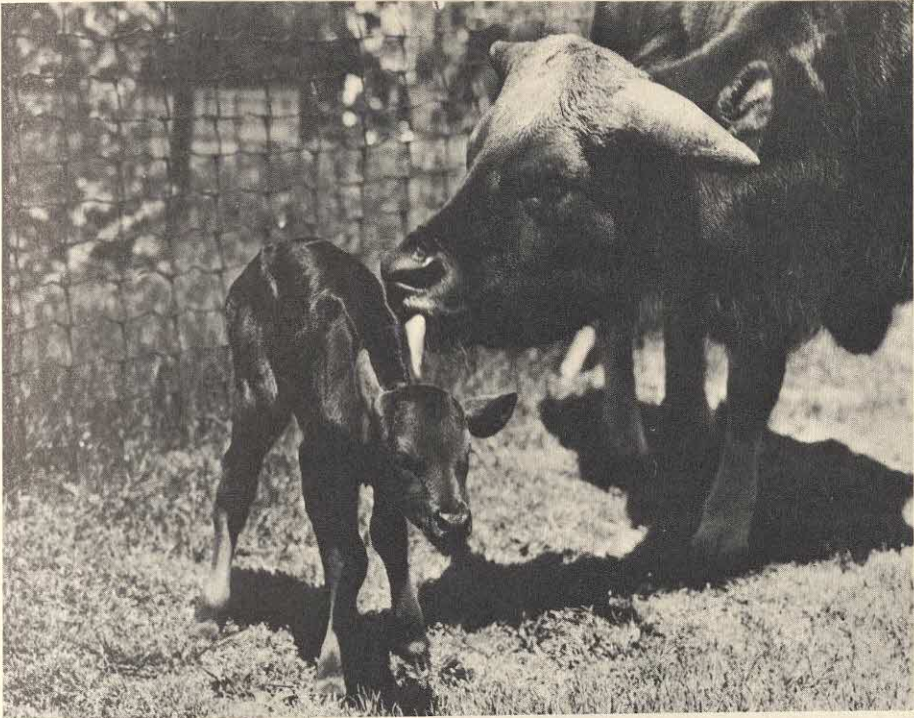


Figure 4-3. This scene is from the film, *Baby Animals*. What kinds of mental action in response to film content like this lead pupils to develop the behavior goals identified by the teacher in this case? (Courtesy McGraw-Hill Book Company, Text-Film Department, New York, N.Y.)

3. Keep simple but accurate records.
4. Care for young animals.

ATTITUDE OF:

1. Kindness.
2. Patience.
3. Responsibility.
4. Reliability and alertness in making observations.

APPRECIATION OF:

1. The loving care that animals give their young.
2. Well cared for pets.

Now again as in the preceding samples of statements of purpose, answer the following questions or make the suggested observations:

1. Note the completeness of second and third understandings in the list, and the insights called for by items 1, 4, and 5.
2. What activity, pointed out in the introductory statement immediately preceding the statement of purposes, was designed to develop abilities 3 and 4?

3. How did the teacher use this science unit in her reading ability development program?
4. Is it perhaps a technical error to double attitudes in her item 4?
5. Is it entirely correct to refer to the *loving* care that animals give their young in the first appreciation in the list?
6. Suggest at least one new purpose of your own for this or any other teaching topic unit. Check yourself against the criteria.
7. Could teachers work together to prepare such objectives for *curriculum guides*? Could sets of purposes be exchanged? Evaluated cooperatively?

THE IRREDUCIBLE MINIMUM

In the light of the foregoing study activity it is appropriate to point out again that when teachers have a valid set of purposes, for a whole course, for a unit of work, or for a part of a unit, decisions about what to do and say are easy. In the absence of purposes, when teachers have a film or an activity they wish to employ, they are in a position to ask themselves, *What might I accomplish with this film showing? Or, What will be the permanent results of my pupils if I lead them through a given problem-solving activity?* It is at this point that the teacher must either embrace the *purpose* concept and check the validity of his thinking or admit that he wants merely to entertain his pupils, perhaps, reward them, or *enrich* the previous material, as so many say, or use the materials with the vague hope that somebody will learn something of value. Many teachers believe that audiovisual technology will help them teach the book better, as it doubtlessly will, but now we have to ask why is the book being taught?

There are those who say that the *irreducible minimum* statement of purpose is the listing of key *performances* that students are to learn to carry out. That is, what are the *abilities*, specific and technical, practical and lifelike, for which students are to be held responsible? In this case the desirable attitudinal and informational objectives are assumed to have been learned without direct effort to identify them. On the other hand there are those who teach the concepts and the generalizations, the facts, and tell what the values are, assuming then that performance in life, that is, such behavior as living democratically, basing conclusions on observed data, and making decisions in the light of learned principles, will follow automatically.

The time and energy may just not be available for optimum planning and preparation. Teachers may not, in those cases, be in a position to write out their purposes at all except in sketchy form. But will those teachers think and act in the light of the valid purposes they say they have *in their heads*? Chances are good that they will do so if the purposes are

really known and are in the foreground of attention, in clear, detailed, and consistent form so as to be usable in the teaching process. This is the irreducible minimum. After all, this is where the *stuff* of our competence must be, that is, *in our heads*, or our behavior patterns will reveal the emptiness to a knowledgeable observer. We must either adopt this kind of thinking and this basis for action or admit incompetency in a basic teaching responsibility.

Applying the Basic Principles

In organizing and planning for the use of audiovisual technology teachers can work either far in advance or on the spur of the moment, but they must plan, for decisions have to be made. These decisions must possess an unerring quality, or youngsters may be deprived of full benefit. They may be harmed and even maimed attitudinally, in performance and comprehension, perhaps permanently.

Therefore in the next set of case studies the five basic principles, set forth and discussed in Chapter 3, are applied. It is to the competencies described in that chapter and to the full statements of the principles as well as to the key words representing those principles that the reader is referred in studying and analyzing the examples provided in the following pages. In each case the reader is asked to make observations in exploring a creative design in using several kinds of audiovisual technological materials as a preface to his efforts to set up a system of his own unique decisions in the light of his own subject-matter field, teaching units, groups of pupils, hypothetical or real, for any specific item of material of his choice.

Before the first example is presented it must be pointed out that it is not suggested that every teacher write out a full and complete plan for every film, filmstrip, language laboratory tape, or slide set to be used in class. What is meant is that teachers must learn to think, plan, and act in the light of facts, principles, and objectives. It is the learning of this process with which we are concerned.

In this first example we offer the thinking and planning of a teacher⁸ in the field of Industrial Arts. Here the teacher patterned his thinking according to a prescribed outline plan made up by the author. An edited version of this completed plan follows.

Case Study Number 1

The teacher has singled out the objective of developing in his students the main ability to bore holes with a bit and brace. He has decided to relate

⁸ By permission of Carl T. Erickson, Stratford, Connecticut Schools.

his own teaching activity to a pupil purpose, the problem of constructing a coffee table. Each of his students has accepted an extensive project of this magnitude. The teacher then brings together the instructional materials, that is, the audiovisual technology and job sheets, and also the text material on operation of various tools to meet the constructional needs of his pupils. We now turn to a terse statement of the teacher's plan for using the film that is in outline form.

PLAN FOR USING THE FILM
BORING AND DRILLING TOOLS⁹
(Teacher Decisions)

A. Class Description

Industrial Arts, Woodworking, Ninth Grade. Unit on Home Furnishings.

B. The SELECTION Principle in Action

My main teaching purposes that the film will help me achieve in my pupils:

UNDERSTANDING THAT:

1. A bit will splinter the back-side of a piece of wood if allowed to go all the way through from one side.
2. A bit or drill must be kept at right angles to the wood being cut to insure a hole that is straight and true.
3. Bit sizes are given in thirty-seconds of an inch.
4. The cutting angle on drills is larger for wood-cutting than for metal cutting.
5. Chips are carried out of the hole by means of drill flutes.
6. A positive starting point is necessary for the accurate placement of the drill or bit.
7. A ratchet type bit brace allows the individual to bore a hole in difficult to get at places.
8. Screw heads may be placed flush by means of countersinking the hole.
9. A bit cannot be used to enlarge an existing hole.

ABILITY TO:

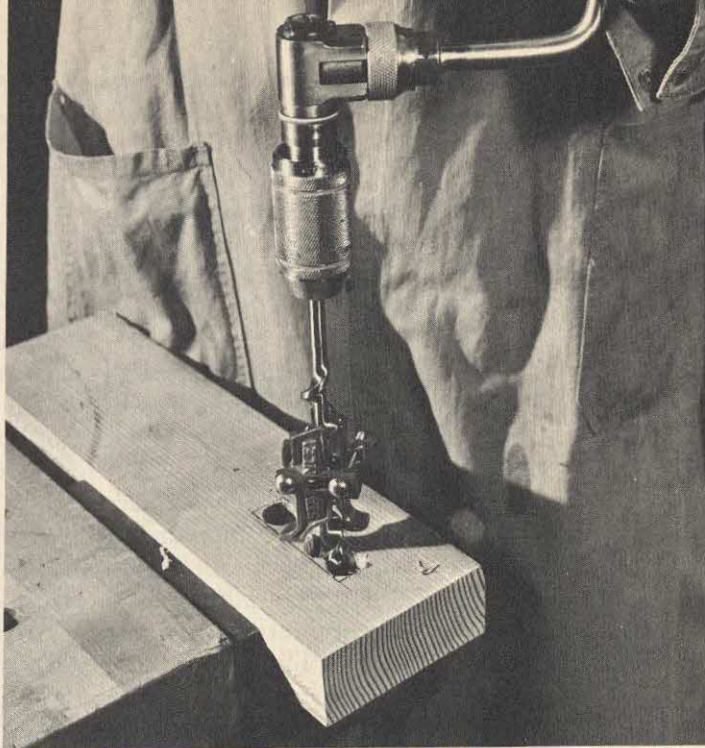
1. Bore a hole using bit and brace.
2. Adjust a ratchet bit brace to its three positions.
3. Fasten a drill in a hand power drill.

ATTITUDE OF:

1. Exactness.
2. Industriousness.
3. Willingness to practice skills.
4. Patience.

⁹ *Boring and Drilling Tools*, McGraw-Hill Company, Text Film Department, New York, N.Y.

Figure 4-4. The demonstrations of proper use of tools in the film, *Boring and Drilling Holes*, may be observed by large groups of students without obstruction by means of the motion picture close-up photography process. (Courtesy McGraw-Hill Book Company, Text-Film Department, New York, N.Y.)



APPRECIATION OF:

1. Good craftsmanship.
2. Orderly procedure.
3. Accurate layout.
4. Manipulative dexterity.

C. Main Problem

To construct a coffee table. (Identified by teacher and pupils before the film was shown.)

D. Film Title

BORING AND DRILLING HOLES. Selected as a basic technological material to speed the development of the main objectives in relation to a project to which the pupils attached significance.

1. *High Quality.* The film will provide experiences in some of the basic skills that are included in my purposes. Camera work, especially the close-up shots, clearly shows the entire class many of the intricacies involved in the various operations. Scene sequence provides smooth transition from one activity to another. The vocabulary used is within the level of the students. Terms used throughout the narration are those that should stimulate pupil participation when the film is over.
2. *Unique Characteristics of the Group.* The class will, under normal circumstances, have had two years previous industrial arts experience. It is expected that each pupil will have an understanding and comprehension of many of the related materials seen in the film. Normal physical development of the boys should be such that they will be capable of performing the operations as shown.

E. The READINESS Principle in Action

(Elements of the Readiness Plan.)

1. Having planned to set up the problem before the film is the first and foremost element in my readiness plan. The student is aware that his project must be assembled in order to serve its intended purpose. He has already cut to size the elements, i.e., legs, cross-pieces, table top, etc. To further prepare the students for this film I plan to comment as indicated in the subsequent items:
2. "Now that the parts of your table are cut to size, what will you have to do to assemble them?" (A display of model joints will be exhibited for study to guide their choice.)
3. "Most of the joints and methods of assembly that have been discussed require the use of certain tools and machines. These are, bit, brace, etc." (I shall put the list on the chalkboard.)
4. "We are fortunate in having a very good film to help us solve some of our problems. By means of this film, you will see skilled workers using the same tools, doing the same things that you will do in order to put these pieces of wood together in such a way that your table won't fall down when your folks put that tray full of cookies and doughnuts on it."
5. "Watch carefully the way the bit is kept at right angles to the wood, how the problem of working near a corner is solved, and how the screws are put in flush with the surface of the wood."

F. The CONTROL Principle in Action

I shall make arrangements to insure that the film, projector, and screen will be in the shop at the appointed time. A qualified student projectionist will handle the projector operation. I shall check such items with him as proper focus, cleanliness of the lens, proper tone control and volume settings, amplifier "warm up" period, and starting signals. As soon as the projectionist is ready to start the film, I shall call the class to the viewing area. Students previously assigned to such duties as pulling the shades, standing by the light switch, and posting a notice on the door informing potential visitors that a film is in progress would then carry out their work. I shall then carry out my introduction of the film and carry out the steps in my readiness plan.

G. The ACTION Principle at Work

(Elements in the plan to elicit student responses.)

1. At the conclusion of the film I plan to conduct a rapid-fire question period according to students' needs, starting off with the following:
 - (a) "How was the bit checked to see if it was at right angles to the wood being bored?"
 - (b) "What do you think would happen if the chips were not carried out of the hole along with the flutes?"

- (c) "A number of mechanical principles were involved in such tools as the automatic screw driver, the bit, point, the edge of the drill, the ratchet, etc. What are these principles and in what other tools or machines are they found?" (This would be suitable for a production experience such as a display depicting mechanical principles in everyday tools.)
2. After this discussion I plan to suggest a second showing of the film to permit a careful analysis of the steps in the bit and brace drilling processes. I plan to stop after each basic operation and check the steps in the process.
 3. I would then emphasize the main problem of proceeding with a project in the light of the film content and ask the following question: "Having seen the processes in the film, how do you think the cross-piece would be fitted to the table legs? The leg to the top? What tool would you use to make the screw holes? Would you countersink the screw on the bottom of the table top? Why?"
 4. I then plan to set up a practice session before proceeding with the work on the main project.
 5. This action plan relates to the main problem because the pupils will construct their project using the tools, machines, and processes that they have viewed in the film.

H. The EVALUATION Principle at Work

I plan to ascertain if the film quality and content are helping me teach more effectively, and determine also if I have employed the best teaching techniques to accompany the film. I plan to make these judgments in the light of my teaching purposes, the previously listed understandings, abilities, attitudes, and appreciations.

ANALYSIS OF CASE STUDY NUMBER 1

This chapter provides opportunities for the reader to develop insight into the ways that the *five basic principles* are applied to teaching with audiovisual technology. It has been emphasized repeatedly that fundamental to all creative teaching is the need for valid objectives, and hence several samples were set forth for observation. In the preceding case study the five principles discussed in Chapter 3 were applied in the creation of a simple though rather complete design for a given teaching situation, one design among an infinite number that is valuable here because it can be examined by the prospective teacher to derive guidance for his own real and/or hypothetical planning activity.

In carrying out the analysis, the case study itself, and the discussion and statement of each of the five principles in Chapter 3, should be used as basic points of reference. We are here concerned with mastery of ideas.

Therefore in order to derive maximum benefit it is suggested that the reader proceed item by item in the following list to make the responses called for.

Ordered Sequence of Responses

1. According to the order of major items in the teacher's plan, did the purposes come first?
2. In this plan did the selection of the film appear before or after the statement of purposes?
3. Is the film in this instance, then, selected to help achieve this teacher's objectives? Or, was the film chosen first to be shown as an end in itself?
4. In this plan does the *main problem* appear before the film?
5. If the film follows the main problem, it must then contribute in some way to the solution of the problem. What can the motion picture and other materials like the textbook, charts, filmstrips, tapes, and visualized programmed learning sequences contribute? Serve as a visual source of information and direction for procedure? Help establish standards of excellence, that is, standards for achievement? Develop a desire to practice? Provide a favorable viewing position otherwise unavailable for a whole group? How do you think the successful completion of the coffee table after hard work and painstaking practice would help to develop the stated attitudes and appreciations? How should the teacher make sure that needed information was learned? Check sheets? Short quizzes?
6. Formulating purposes and planning effective learning experiences are two prime acts of a good teacher. Now, in the teacher's plan, the construction project is the significant, challenging pupil purpose. The problem-solving activity is vital and central. Check the *teacher's purposes* and then answer the following: How does work on the problem achieve the understandings, abilities, attitudes, and appreciations? How would textbooks and charts help? How would the motion picture help the teacher? (Check answers in item 5 again.)
7. Was the film therefore selected in the light of a pupil problem-solving activity? What did the teacher believe about the quality of the film and its fitness for his particular group? What characteristics of the motion picture made it appropriate for achieving the stated objectives?
8. Note that the *readiness principle* is applied by a plan with several elements. What does having a pupil *problem first* have to do with readiness to look at a film? What other specific techniques did the teacher plan to carry out? Are such techniques included in the list of possibilities in Chapter 3? How does having a problem first make the readiness plan easy to make? Helps analyze the needs of pupils? Makes

it easy to decide what questions to ask? Set up main points to look for in terms of their project operations?

9. There must be a minimum of distraction in handling a film screening. What can you do to become a good organizer? How can students help? Should you hold the screening process to high standards? Check Chapters 3 and 7 for complete information.
10. Check the section in Chapter 3 that deals with eliciting responses and then note the teacher action plan in this case study, answering the following items:
 - (a) Why is the action planning made easy by having a problem prior to film showing? [Note G (1) (a) (b) (c).] Is it easy to ask better thought-type questions to guide student thinking? When developing handwork abilities is knowledge important? Judgment?
 - (b) Note reference to main problem in G (3), then note the practice session with the tools before application to the project in G (4).
11. Anyone who organizes his work well and has good purposes finds evaluation easy. What basic and simple questions should you ask yourself? Check Chapter 3 at this point.
12. The preceding case study indicates original thinking on the part of the teacher. Identify the parts of the teacher's plan that clearly indicate areas for your own potential ingenuity:
 - (a) Formulation of understandings, abilities, attitudes, and appreciations? (Improve or add additional items.)
 - (b) Having a good pupil or group problem or a series of thought-type questions and assignments first? Suggest some possibilities in your own field. Do you see that a good learning activity is the medium for learning? Is the problem in the teacher plan one that demands use of the ability that the teacher seeks to teach? Do teachers have to be creative in their choice of problems for students to solve?
 - (c) Do teachers have to be creative in devising ways to motivate students? What are some additional readiness building techniques? How could you use students to help build readiness in the class to view, think, react, take action, and work hard at practice? What creativity is needed in preparing guide sheets before a film or filmstrip, tape or overlay transparency, and slide-set or television program?
 - (d) Do teachers have to be creative organizers and managers in the efficient handling of classroom arrangements for utilization?
 - (e) Do teachers have to be ingenious in the guidance of student reaction during or after use of devices and materials? Does good

guidance in discussions demand good thought-type questions? Are how-to-do-it guide sheets often helpful? In the preceding plan the main pupil problem was identified first to maximize the readiness of pupils and to serve as a focal center for the learning of skill, understandings, and attitudes. Could not the teacher have decided to show the film first as an introduction, then discuss and practice, and then introduce functional application of the ability to the construction of an important piece of furniture or device for home, school, or another school? Could the information giving and the demonstration aspects for several skills have been presented by means of closed circuit television to large groups, that is, to several classes combined or to individual class groups in various rooms, with guide sheets for readiness and subsequent action, in a team-teaching situation?

- (f) Do teachers need to think clearly when they appraise materials just used? Does the critical scrutiny of one's own previously used techniques (decisions) demand courage and objectivity?
- (g) Is the whole process of deciding what to do a creative process? A systematizing process? Focused on and through a set of valid teaching purposes?
- (h) Would a good set of teaching objectives, as a part of a teaching unit, make teacher decisions easier?

The pivotal factor in the preceding utilization plan is the place of importance given to the constructional problem. The placement of the problem deliberately before the film deserves emphasis. A great many teachers do not understand this procedure very well and hence do not use it. In the next case study we shall explore the *problem base concept* further.

Case Study Number 2

The next case study gives the reader an opportunity to get an overall view of a fifth-grade teacher¹⁰ who planned to use a film, *Panama Canal*,¹¹ in direct relationship to a project of the class that was encouraged by the teacher in the light of her objectives. Her planning is revealed in the same outline format shown in Case Study Number 1, but only edited excerpts of the complete plan are shown here for the sake of emphasis.

¹⁰ By permission of Cora Kibbe Pelletier, Ledyard, Connecticut Public Schools.

¹¹ *Panama Canal*, Coronet Films, Chicago, Illinois.

We now turn to the teacher's purposes, the project, and the plan for ensuing action and relationships.

PLAN FOR USING THE FILM, *PANAMA CANAL*
(Teacher Decisions)

A. Class Description

Fifth-grade Social Studies. The topic under immediate study is the Panama Canal Zone.

B. The SELECTION Principle in Action

My main teaching purposes that the film will help me achieve in my pupils:

UNDERSTANDING THAT:

1. The construction of the Panama Canal was a long, difficult, and dangerous project because of the:
 - (a) High mountainous area.
 - (b) Dense jungles.
 - (c) Tropical climate.
 - (d) Presence of disease-carrying insects.
2. The Panama Canal is a vital link in the world's trade because it connects the Atlantic and Pacific Oceans at a central point.
3. A lock is an inclosure in a canal with gates at each end, used in raising or lowering boats as they pass from one level to another.
4. The Panama Canal is made up of a series of locks.
5. The Panama Canal would not be possible without the system of locks because the land is higher at the center of the isthmus than at the coastlines.
6. The United States owns the Panama Canal Zone, but it lets boats of many countries use the Canal.
7. The Panama Canal is constantly and carefully guarded from destruction because of its importance as a vital waterway for world trade.
8. Even in this air age, more boats than airplanes are used for transport because water travel is cheaper.
9. The Panama Canal is of vital importance to the United States Navy because it provides the shortest water route for the naval fleets from one coast to the other.

ABILITY TO:

1. Solve problems.
2. Use new sources of information.
3. Keep accurate, detailed records.
4. Generalize from specific facts.

ATTITUDE OF:

1. Cooperativeness.

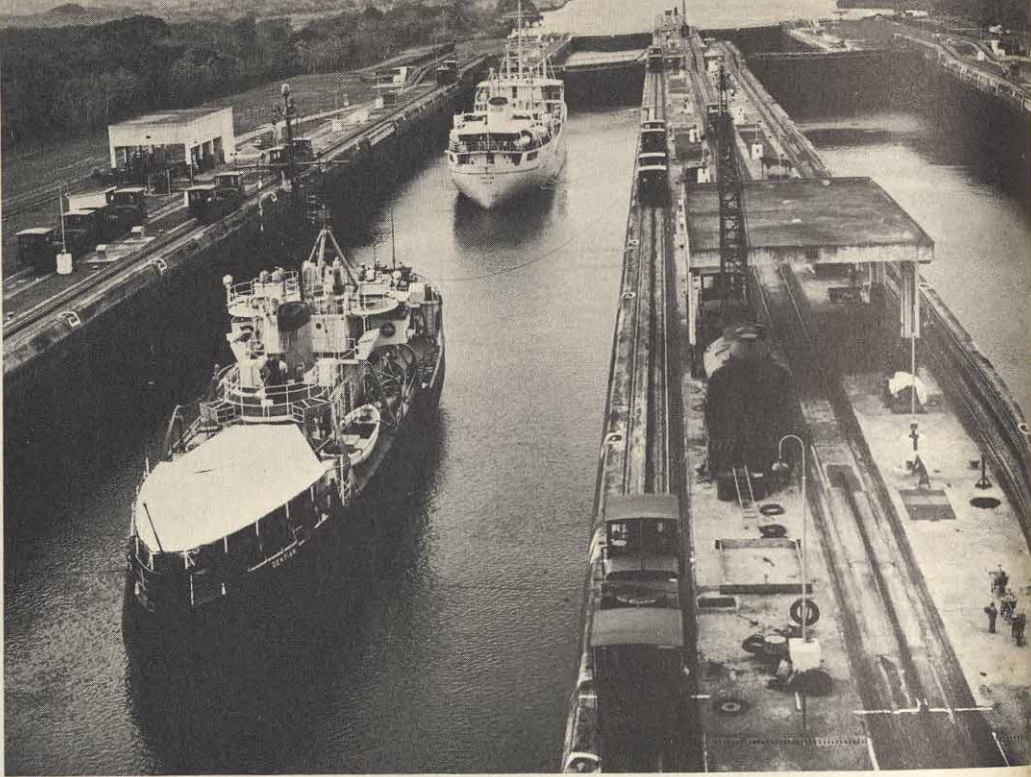


Figure 4-5. This view from the film, *Panama Canal*, indicates why it would be of value in the problem-solving processes of the youngsters. (*Coronet Instructional Films, Chicago, Ill.*)

2. Friendliness.
3. Open-mindedness.
4. Inventiveness.
5. Responsibility.
6. Desire to base opinions on facts.

APPRECIATION OF:

1. Good workmanship.
2. Well-planned action.
3. Good problem-solving techniques.

C. Main Problem

Organize and construct a display dealing with the Panama Canal Zone for the Pan-American Day Exhibit. (A model of the Canal to be included in the display.)

D. Film Title

Panama Canal, selected in direct relation to the pupils' project but also in relation to the teacher's purposes.

1. *High Quality.* The film, *Panama Canal*, is of high quality because:

- (a) The picture images are sharp especially in the important lock scenes.
 - (b) The sound is clear and natural and the commentary is given at a comfortable rate for our purposes.
 - (c) The action is at a sufficiently rapid speed to maintain interest.
2. *Unique Characteristics of the Group.* The children have previously studied the continents of North and South America, and the film's content and continuity endow it with a rich potential to serve the needs of this class because of the project to be worked on.

E. The READINESS Principle in Action

(Elements of the Readiness Plan.)

1. Having the problem first sets up the significant basis in the minds of the pupils for using the film.
2. The film will be related to the problem in the following manner:
 "As planned yesterday, we are going to construct a school display for Pan-American Day.

We have been studying the North and South American countries and it certainly would be unwise for us to end our study of this hemisphere without having taken a close look at one of the most important zones in this hemisphere. This zone is the Panama Canal Zone.

The Panama Canal is a good example of cooperation between many countries. This cooperation in the Canal Zone can serve as a good problem for our display for Pan-American Day which is coming up soon.

We are going to see a film today which will help us to understand more about the Panama Canal Zone; the film is called *Panama Canal*."

3. "Before we view the film, I would like you to:
 - (a) Skim through the pages of your text to find the meanings of the two terms which I have written on the chalkboard.
 - (1) Panama Canal Zone.
 - (2) Locks.
 - (b) Find the Panama Canal Zone on the wall map and trace the route of the Canal.
 - (c) Look at the map in your textbook—trace the route of the Canal—note the land forms on either side of the Canal."
4. "On the back of the sheet of paper which I am handing out to you, write three good questions about the Panama Canal and Zone which you hope the film will answer for you. The answers should also be of good use to you in constructing the display."
5. "Now turn to the front of the sheet and look at the five questions which I have listed there for you to answer with the help of the film. If you have written a question that is the same as one of mine, cross out my

question and use the question that is written in your own words.

These are the questions that we hope the film will answer for us:

- (a) What hardships and problems had to be overcome before the Panama Canal could be completed?
 - (b) Why did the United States decide to build the Panama Canal? What other countries had tried to build the Panama Canal?
 - (c) Who owns the Panama Canal? Who owns the Panama Canal Zone?
 - (d) How do the locks in the Canal operate? (Note details.)
 - (e) Why is the Panama Canal so important to world trade?"
6. "Now watch the movie closely to answer the questions and to pick out all the important facts and details which you would like to tell others about by means of your display."

F. The CONTROL Principle in Action

As in the previous case study this teacher made all necessary arrangements to have projection take place at the right time, dovetailing precisely with the preceding readiness plan.

G. The ACTION Principle at Work

(Elements in the plan to elicit pupil responses.)

1. Immediately after the film has been shown, the students will be given a few minutes to answer the questions devised in the Readiness Plan, in a brief, concise form. At the same time noting any further helpful questions or ideas which they might have.
2. I expect to start a discussion with my class concerning the main problem: to organize and construct a display dealing with the Panama Canal Zone for the Pan-American Day Exhibit. (A model of the Canal to be included in the display.) The discussion will be held with the idea in mind that the answers to the questions presented will lead to a plan of action for solving the main problem. I intend to use questions from the question sheet. In addition, these questions will be raised:
 - (a) "What information did this film offer us that would be useful in constructing a model of the Panama Canal?"
 - (b) "What ideas presented in the film will be useful to use in preparing our display for Pan-American Day?"
3. Additional questions needed to help analyze the main problem will be raised:
 - (a) "How may we gather additional information to aid us in giving a complete and accurate display?" (Identify needed information and sources.)
 - (b) "How may we assemble the facts, figures, and diagrams to help people understand the importance of the Canal?" (Identify basic ideas that should be portrayed and decide on the design.)

4. "What research jobs need to be done? What reports should be prepared, and who should make them?"
5. "What work groups do we need to organize?"

It is obvious that the teacher is now ready to work with her class in a stimulating and potentially rich learning activity. The film has provided a vital experience, and the class or selected groups will want to see all or parts of the film again as a source of additional information.

ANALYSIS OF CASE STUDY NUMBER 2

Before proceeding with the analysis of the case study and working through the sequence of responses, readers should return to Chapter 3 for a review of the explanatory material there. The process of designing demands unique decisions in terms of guiding principles.

Ordered Sequence of Responses

1. Are the basic elements in the design of both of the preceding case studies the same? Purposes? Main problem before the film is shown? Relationship of the film to *teacher's purposes* and to *pupil purpose*? What is the difference between the teacher's and pupils' purposes?
2. How do the understandings arise in the pupils' minds? From a complex of mental activity, viewing, recalling, comparing, selecting, manipulating, agreeing after debate, and memory too?
3. Would the abilities stated in the list of purposes develop in the pupils as a result of practice and functional work on the display construction? Work on research? Deciding what to include and how to display it?
4. What other unstated abilities would be likely to develop in addition to those stated? How about learning to read better? Express ideas better? Organize information better? (If the teacher had stated that one of her abilities for the students was to construct models from diagrams, would she have been correct? Is not constructing a model a learning activity?)
5. Refer to *Characteristics of Teaching Purposes*, item 4, near the beginning of the chapter under *abilities*. Take a sharper look at the activity itself. What lifelike performance grows out of making a model? Ability to plan action? Ability to seek and find information? How might the work on the display be likely to develop attitudes of inventiveness, friendliness? Responsibility? Perseverance?
6. Do the procedures for pupil action (questions and guidance) reflect the teacher's deliberate attempt to achieve her identified purposes? In other words do the stated purposes channel the thinking of the teacher

and help her decide what to do and say? Help her guide students in their responses unerringly toward desirable development?

7. Is it clear how books, group work and the film are organized around problem-solving activity? Might not the main problem be, in effect, a topic for the whole teaching unit? A hub for all teaching unit activity?
8. The teacher did not use the film as a "magic carpet" medium. Could she have introduced the film as a journey to the Canal via film? What additional media could be of service? Filmstrips? Recordings? Newspaper pictures? Maps and globes?
9. When the problem is set up before the film, are pupils better oriented for observation and action?
10. Would it not be advisable for teachers to work together to prepare lists of desirable teaching objectives for specific units of work? For courses of study? For curriculum guides?

Case Study Number 3

We now return to a plan for the use of a motion picture ¹² created for another high school class. Again the film is being used by the teacher ¹³ in direct relationship to a problem already accepted by the students. The construction type of project set up with the students is particularly suitable because of the measuring and scaling that would be necessary. The planning by the teacher is shown, as in the previous case studies, in edited, excerpted, outline format.

PLAN FOR USING THE FILM, *THE MATHEMATICIAN AND THE RIVER* (Teacher Decisions)

A. Class Description

General Mathematics, tenth grade. Unit: The Application of Mathematics to Flood Control.

B. The SELECTION Principle in Action

My main teaching purposes that the film will help me achieve in my pupils:

UNDERSTANDING THAT:

1. By the language of mathematics big ideas are compressed into small time and space.

¹² *The Mathematician and the River*, Horizons of Science Films, Educational Testing Service, Princeton, N.J.

¹³ By permission of William D. Wright. Middle Georgia College, Cochrane, Georgia.

2. Computers solve problems much too big and complicated for a single mathematician to handle by himself.
3. Mathematics is the language of the physical sciences.
4. Mathematics is a language of quantity, not quality, that deals with quantities, forms, and relationships.
5. Mathematics facilitates a complete analysis of any problem situation.
6. Mathematics goes beyond facts to underlying principles.
7. The power of mathematics comes not only from its ability to measure quantity, but from its ability to deal with numbers and abstract symbols.
8. Mathematical equations that are used as models of physical situations are even more compressed than physical scale models that compress time and space.
9. From the proper mathematical equations for the flow of a river that are fed into an IBM computer it is possible for the computer to give the depth of the river at any desired point along it.
10. Mathematics provides a relatively simple way of expressing the forces (e.g. pressure, friction, resistance) and factors (e.g. volume, mass, velocity, momentum, depth, cross section) at work in a river.
11. Mathematical equations are the only way of precisely expressing, analyzing, and applying the principles of the physical universe.

ABILITY TO:

1. Formulate simple physical problems symbolically.
2. Locate sources of information.
3. Interpret graphs and charts.
4. Construct graphs and charts.
5. Compile accurate records and statistics.
6. Evaluate the effect various factors have on one another and on the total physical situation.
7. Draw conclusions from facts.

ATTITUDE OF:

1. Inquisitiveness.
2. Perseverance.
3. Criticalness.
4. Cooperativeness.
5. Responsibility.

APPRECIATION OF:

1. Effective scientific observation and experimentation.
2. Analytical problem-solving.
3. Logical procedure.
4. Thorough research.
5. Good organization.
6. Good teamwork.

C. Main Problem

Construct a school display showing the many ways in which mathematics can be used in flood control. The display will consist of a scale model of a section of a river, charts, graphs, tables, flat pictures, diagrams, drawings, and maps.

D. Film Title

THE MATHEMATICIAN AND THE RIVER, was selected in direct relation to the pupils' problem, but in addition was also selected in direct relation to the teacher's purposes.

1. *High Quality.* This film is a good one because it truly answers a question most students ask, namely, "Of what real practical use is algebra and plane geometry and all that theoretical math?" It shows the relationship between the abstract world of mathematics and the real world of nature and does so with plenty of action in color and with the excitement of many intriguing and thought-provoking questions.
2. *Unique Characteristics of the Group.* Most of the students in the class are interested in weather, nature, and outdoor living. The study of flood control fascinates them. Since all have studied simple algebraic equations and their applications and have had a good course in ninth grade General Science, their experience level is of sufficient depth for them to comprehend the film's instruction and to profit from it.

E. The READINESS Principle in Action

(Elements of the Readiness Plan.)

1. The first element of readiness is having the main problem prior to the film since this establishes in the minds of the students a significant basis for viewing the film.
2. The film is related to the main problem as follows:

"As we planned last Friday you are going to construct a school display exhausting in so far as possible the ways in which mathematics can be used in flood control. Already each of you has applied the principle of division of labor by voluntarily joining one of the three committees you decided to set up. (You recall you discussed and suggested as a class how each of the Committees—the Research and Statistics, the Scale Model, and the Graphic Arts—might get started on its part of the project.)

Today we shall view a film which will give you further ideas on how your committee can do its job. As you watch *The Mathematician and the River*, if you are a member of the Research and Statistics Committee, jot down words, such as velocity, volume, mass friction, Louisville Flood, that will guide you in your reading and lead you to facts useful to the other committees in making the display. If you are on the Graphic Arts Committee, jot down ideas for graphs, charts, diagrams, drawings, pictures, photos, and the like. And if you are a



Figure 4-6. These views of a portion of the scale model of the Mississippi river and of the actual river terrain are from the film, *The Mathematician and the River*, one of ten in the *Horizons of Science Series*. (Courtesy Educational Testing Service, Princeton, N.J.)

member of the Model Committee, you will want to jot down ideas and list kinds of materials that will help you in making your scale model. The Scale Model Committee may wish to see the film several times in order to understand better how to utilize these ideas and materials."

3. Write the following key technical words and phrases on the chalkboard and discuss their meanings before showing the film: friction, mass, velocity, momentum, Newton's equation for the conservation of mass, Newton's law of conservation of momentum, resistance.

F. The CONTROL Principle in Action

I will arrange to have the film, the projector, the loudspeaker, and the screen in the classroom before the beginning of the class hour in which the film is to be shown and properly placed for optimum viewing and effortless listening, rearranging the seating where necessary. When all the equipment is set up I will check and correct where necessary the following: the speaker connections, the cleanliness of lens and aperture, the sharpness of image of the projector's "field of light" upon the screen, the winding of the film on the reel, the film threading, and the volume and tone. At the end of the readiness period, previously appointed students will pull the window shades and turn off the lights upon a signal from the projectionist.

G. The ACTION Principle at Work

(Elements in the plan to elicit pupil responses.)

1. As soon as the motion picture has been shown I will hold a brief discussion with the entire class, asking what new ideas they got from the film that would be of help to each of the committees in doing its part to construct the display. Three students (one from each committee) will write each new idea on the chalkboard as it is mentioned. In this way each committee pulls ideas and observations not only from member students but also from students on other committees.
2. "Because the film is rather technical you may not feel that you have been able to see in one viewing all the ways it can help your committee in the construction of the display. For this reason we will re-run the film again tomorrow. Immediately following this re-run, you will be tested on the mimeographed questions that I shall now hand out. If there are any answers you cannot recall, you'll be able to get them at this second showing. Also, you can check your answers as you view the film this second time. These questions and their answers will stimulate your thinking and some of them will contribute directly in helping you and your committee to do its job in the display. The questions referred to are as follows:
 - (a) When present-day problems are much too big and complicated for an individual mathematician to handle by himself, how are they solved?
 - (b) What kind of language is mathematics?

- (c) What is the most direct way in which mathematics can be used in flood control? (HINT: What is the problem that Prof. Eugene Isaacson is working on?)
 - (d) What physical factors must be considered when studying the flow of water in rivers?
 - (e) Where does mathematics derive its power?
 - (f) How can a scale model of a river be used? Which factors affecting the flow of water in the model are kept constant?
 - (g) With regard to the principles of the physical universe, of what practical use are mathematical equations?"
3. At the beginning of class the next day we will re-run the film without comment, stopping it whenever this is requested. After the film, a quiz will be given on the assigned questions. To conclude the session I will re-state the main problem to the class, summarize what action has been taken thus far to solve the problem, and recapitulate the new ideas gained from viewing the film. Then I will ask each committee what specifically its next step will be and ask it to devise and submit for approval a brief written specific step-by-step plan of action in outline form. I will then distribute to each group the following list of additional guide questions needed to help analyze the main problem of constructing the display and to provide suggestions for further action on the part of each committee.

RESEARCH AND STATISTICS COMMITTEE

- (a) With respect to the topic "Mathematics in Flood Control," list all potential sources of flat pictures for mounting, of information for obtaining or constructing tables, graphs, charts, diagrams, drawings, and maps, and of subjects suitable for photographing.
- (b) From this list obtain whatever materials and information are requested by the Graphic Arts Committee for use in making all parts of the display except the scale model.
- (c) What sort of statistical and technical data will you need to compile for use by those who are constructing the scale model? List the names and addresses of those in the Army Corps of Engineers who were responsible for constructing the scale model of the Mississippi system and who could provide helpful suggestions as to how to go about making such a model, and supply answers to technical difficulties encountered by the Model Committee.
- (d) What kind of statistical information on rivers and flood control can be obtained from county, state, and national conservation agencies?

SCALE MODEL COMMITTEE

- (a) How will you go about deciding what river and what section of that river you will model to scale?
- (b) What materials will you use in constructing the scale model of a section of a river?

- (c) How will you indicate on the scale model what physical factors are at work? What audio-device could you use alongside the model in order to explain to observers of the display how these factors interact and affect one another.

GRAPHIC ARTS COMMITTEE

- (a) Prepare a list of as many titles and captions as possible for potential graphs, charts, diagrams, flat pictures, maps, photos and drawings to be used in the display. How will you indicate how mathematics is involved in each?
- (b) Prepare a series of rough work sketches of the actual graphs, charts, diagrams, drawings, maps, and mounted photographs and flat pictures you intend to construct and collect for the display.
- (c) What kinds of drawings and photographs will you make in order to alert the viewers of the display to the contributions mathematics can make in educating the public to the need for flood control and to the practical measures that can be taken to achieve it?

This teacher is apparently now ready to guide members of his class in their attack on a new and challenging problem-solving experience.

ANALYSIS OF CASE STUDY NUMBER 3

The pattern of teacher decisions clearly follows the five principles as set forth in Chapter 3. This case study shows that the teacher was concerned not only with the process to be followed by pupil committees in their own research and construction, but in addition he showed a laudable concern for the subject-matter substance, not wanting to get lost in the process of the class project. He therefore planned a quiz, as one way to encourage the mastery of some of the basic ideas as presented in the motion picture, which had been already identified in his purposes. We shall now turn to the list of questions and judgments to aid the reader not only in his analysis of the present case study, but also in his own thinking and planning for his present and future teaching activities.

Ordered Sequence of Responses

1. Compare the statements of teaching purpose in this case study with those preceding. Why do teachers seem to repeat attitudes in different courses at different levels? Are attitudes pervasive or specific in character?
2. Would the list of abilities stated be likely to be developed in the activity of committee processes to plan, figure, and construct? Are pupils likely to learn much of factual information together with the abilities? Should not the teacher guide and encourage students to read widely

and to work vigorously? Should the teacher teach criticalness by his own actions? By his sharp appraisal of students' work? By his knowledge of what each student is contributing? Do the stated purposes facilitate the teacher's critical analysis of pupil achievement?

3. How would students in this case learn the appreciations stated? What would they learn if forced into or commanded to take part against their will? Is it true that appreciations will develop faster if pupils like what they are doing? Get satisfaction out of work being well done? Can people learn to like to solve problems?
4. Could discovered weaknesses in students be corrected by extra assignments, homework, and guidance by special drills and exercises during other study periods?
5. Did this teacher properly relate the film to the class problem in Section E? Did pupils on the committees know what to look for in the film? Did everyone know why the film was being shown? Do you believe pupils react to and put in more hours of work when a teacher is well organized and knows how to put his materials together for better learning?
6. It is not easy to organize a class group for action on a problem that calls for new responses. Teachers willing to tackle problems with pupils are to be commended. Do you believe some students would be willing to work on such a project after school, that is, if the progress became slow and the deadline were approaching?
7. Do you recognize the fact that the production of the display was the central hub around which all activity revolved? Was the motion picture thus primary or secondary in the stream of activity? But would it not be an important learning experience? Is this not a vastly different process from just looking at a film that happened to be in the school?
8. Did the class committees work on their project like a research team? Is this a good way to develop the ability to work together?
9. Not every problem has to be a large class project. Some problems may take the form of a question that can be completed by a film and a follow-up discussion fifteen minutes long. These are matters of teacher decision, timing, and pacing, as related to the nature of the objectives in view.
10. Refer to section D, *Film Title*. The film in question was used in direct relation to the pupils' problem (the pupils' purpose). Is it correct to also say that the film was selected to serve the teacher's purposes? Are pupils' problems media for acquisition of desired understandings, abilities, attitudes, and appreciations?

Case Study Number 4

The first three case studies have shown the use of a motion picture in vital relationship to a problem already formulated and accepted by the class. That is, the pupil problem, assignment, or project came first, and the motion picture, books, and other instructional materials such as slides, filmstrip, and textbook illustrations were brought in as sources of information, of directions for procedure, and as sources of vicarious (although intensely realistic) experience.

In this case study we show the same teacher¹⁴ as in *Case Study Number 2* in a vastly different design for the utilization of the same film to achieve the same set of objectives. The main point of this case is to show that the crucial pupil activities grow out of the film showing and the subsequent discussion and guidance. The teacher in this case may or may not know what actually will be done after the film showing is completed. In this particular instance the teacher actually had planned a series of questions and then finally wished, or hoped, to introduce to her pupils the class project of constructing a school-corridor exhibit about the Panama Canal for Pan-American Day.

The case therefore is a variant of Case Study Number 2. Its statement in brief form tends to sharpen the emphasis on the positioning of the main pupil activity.

PLAN FOR USING THE FILM, *PANAMA CANAL*

(Teacher Decisions)

A. Class Description

Same as for Case Study Number 2.

B. The SELECTION Principle in Action

Teaching purposes are the same as for Case Study Number 2, and the statements in that case about film quality and its fitness for a specific group of teachers are also applicable to this case.

C. Main Problem

There is no main problem before the film is shown.

D. Film Title

Same as for Case Study Number 2.

174 ¹⁴ By permission of Cora Kibbe Pelletier, Ledyard, Connecticut Public Schools.

E. The READINESS Principle in Action

(Elements of the Readiness Plan.)

1. I plan to introduce the film as follows:

"We have been studying the North and South American countries and it certainly would be unwise for us to end our study of this hemisphere without having taken a close look at one of the most important zones in this hemisphere. This zone is the Panama Canal Zone.

The Panama Canal is a good example of cooperation between many countries.

We are going to see a film today which will help us to understand more about the Panama Canal Zone; the film is called *Panama Canal*."

2. "By means of this motion picture we can take a trip to this locality to observe how the canal operates and to get a better idea of the problem of accomplishing this great engineering feat. Before we set out on our film journey, I suggest that you do three things. I have them written on the chalkboard:
 - (a) Skim through the pages of your text to find the meanings of the two terms which I have written on the chalkboard
 - (1) Panama Canal Zone.
 - (2) Locks.
 - (b) Find the Panama Canal Zone on the wall map and trace the route of the Canal.
 - (c) Look at the map in your textbook—trace the route of the Canal—note the land forms on either side of the Canal."
3. "We shall discuss our film journey and our observations and any questions you wish to ask as soon as it is over. Ready? Here we go to this world famous place!"

F. The CONTROL Principle in Action

Same as in Case Study Numbers 1 and 2.

G. The ACTION Principle at Work

(Elements in the plan to elicit pupil responses.)

1. I plan to hold a discussion about our film journey emphasizing concepts and abilities listed in my teaching purposes. After this discussion period, I intend to move toward specific projects guiding this work by individuals and groups with work sheets, map work and discussion.
2. Specifically, I will elicit questions from the pupils and will ask the following questions of my own proceeding from simple thought-type questions to the formulation of a project involving the entire class in committee work, reports, research and final construction:
 - (a) What was the main reason for the building of the Panama Canal?
 - (b) List some of the reasons why the Panama Canal was built in the Panama area?

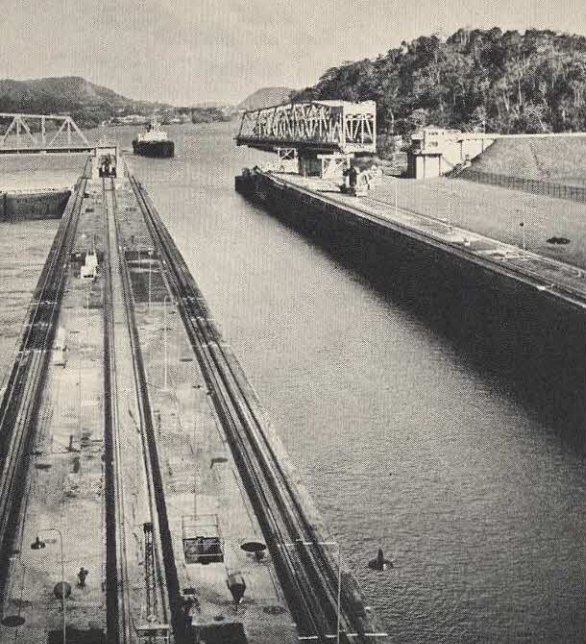


Figure 4-7. In the case study under consideration, the teacher used the film, *Panama Canal*, as a "magic carpet" to travel to a distant country for on-the-spot observation. These views of the operation of the Canal indicate how the film would serve as a potentially great springboard, to catapult pupils by their own newly stimulated interests into desirable pupil activity. (Courtesy Coronet Instructional Films, Chicago, Ill.)

- (c) What conditions had to be overcome before the Canal could be built?
 - (d) Could additional information be found to help us better understand how great these difficulties were?
 - (e) Many people do not know how the locks of the Canal actually work. In what ways may we help them understand their operation? Could we work as a production crew to make an exhibit for Pan-American Day for the main corridor to show: the vital location of the locks; the importance of the Canal; and the world-wide co-operation which they foster?
3. Once the class accepts the problem I shall guide pupils in analyzing the work that has to be carried out to complete the project, and shall work along with them in solving problems and helping class leaders direct the work of their respective groups.

H. The EVALUATION Principle at Work

Same as for Case Study Number 2.

ANALYSIS OF CASE STUDY NUMBER 4

Again the reader is urged to review or peruse concurrently with the
 176 analysis of the case, the pertinent material provided in Chapter 3, and he

should also bear in mind the teacher decisions made in Case Study Number 2.

Ordered Sequence of Responses

1. Note first the generality of the *readiness* plan, an introduction to future activity, not yet known to pupils. At this point, maybe the teacher has doubts about pupil acceptance of the project she hopes to set up. Would the trip idea add a touch of glamour to the film showing? Is it better psychology to suggest *going* instead of *bringing* the Canal to the class?
2. Note next the *action* plan, G-1, 2. The discussion can be guided by the teacher, but it can be widely diversified because of the unrelated questions of each of the pupils. Could such a discussion be too time consuming? What should be done if pupils do not react to the project suggestion by the teacher?
3. Now, going back to the *action* plan in Case Study Number 2 for contrast. What advantage is there to having a problem first? Is there a more definite relationship of the film showing to what is going on in class? Are both teacher and pupils likely to make more direct observations in the film content? Feel a keener sense of involvement? Can there be a more direct and efficient attack on a problem as soon as the film has been completed? Would the teacher know better what to discuss and could she get at it quickly?
4. Could teachers arrange to set up a larger number of smaller activities, questions, and problems after an introductory film showing?
5. Could teachers arrange to have work sheets for students to fill out after a film in the case where the film was used to present subject matter to be mastered? Should the problem or problems in this case be highly specific, and should the responses be in accordance with the teaching objectives?
6. Could teachers prepare and issue guide sheets prior to film showings that raise a series of questions to be answered later? Could such questions direct the attention of the learner to important items in film content?
7. How should the required responses of pupils either during work on large class problems, or on special guide sheets be related to the teacher's objectives?
8. Check through the learning activities and judge whether or not the objectives of the teacher help her to choose the right activity, emphasize the right points, guide the pupils in their study, observations, and conclusions.

Case Study Number 5

Earlier in the chapter several sample sets of teacher purposes were quoted, and this next case study refers directly to the first set, Sample 1, formulated by a teacher¹⁵ in connection with a teaching unit about *The Westward Movement*. The reader should therefore refer to that set of purposes now and then check the edited excerpts of the teacher's plans for achieving them. In this case study we are dealing specifically with the *readiness* and *action* principles. These decisions show that no major problem was established before the showing, and this means that despite a listing of specific and varied questions for pupils to discuss, the really important and challenging projects had to be set up after the film.

PLAN FOR USING THE FILM, *PIONEER OF THE PLAINS*¹⁶

Class Relationships

For an eighth-grade class in Social Studies. The teaching unit was *The Westward Movement*. The special aspect for consideration was the life, problems and character of the pioneer. (Refer to statement of objectives, Sample 1, earlier in this chapter.)

Readiness Plans

We join the teacher at the point in her plans where she expects to introduce the possibility of a trip to the West with a pioneer family.

1. "... Yes, the best way to learn more about the pioneer is to actually join members of a pioneer family in their trek from Illinois to the Great Plains, and we can do this by means of a film. In just a few minutes, Bob will flick the light switch and this will automatically take us back to the year 1870, and then Gary will turn another switch to transfer us from this room to the covered wagon of the Carter family. Remember, this wagon won't have the same comfortable seats as our automobiles, and the trails won't be as smooth as our highways of today. Be prepared for a good jouncing! Bring a pillow!

Before anyone starts a journey, he usually knows where he's going. Sue, please find Illinois on the map and run your finger from it to the Great Plains region. Thank you. This is the route we'll travel. After reading your special assignment for today, do you have any questions that you think our trip may answer? I've already prepared a trip guide which I think will help us to really see things, let's look it over now and see if you wish to add some items."

¹⁵ By permission of Shirley M. Titus, West Hartford, Connecticut Public Schools.

¹⁶ Encyclopaedia Britannica Films, Wilmette, Ill.

2. The trip guide posed the following questions:
 - (a) Would you like to live in a sod hut?
 - (b) What is a pioneer? Do you think there were pioneers living three thousand years ago? Are there any living now? Will there be any in the future?
 - (c) Would you like to be a pioneer? If so, what kind? What preparations would you have to make to become this kind of pioneer?
 - (d) Why do you think the Carter family was willing to leave their established home and friends to settle in an unknown region?
 - (e) How long do you think the Carter family had been planning their trip westward? Explain.
 - (f) During what month did they leave Illinois? Why do you think they chose this time to begin their journey?
 - (g) If you had been traveling with the Carters, what would you have eaten, where would you have slept, and what would your chores have been?
 - (h) What problems and dangers did the Carter family face?
 - (i) Was the Carter family completely self-sufficient or did they have to depend on others once in a while? Do you ever depend on others?
 - (j) In what ways was life on the plains different from life in Illinois?
 - (k) How do you think Mrs. Carter felt when she saw her new home? Have you ever felt this way? How did she meet her problem?
 - (l) Do you think you could build a sod hut? How would you begin?
 - (m) Do you think music is an important part of people's lives? Was it important to the Carters?

3. The teacher plans to proceed as follows:

"Item (m) is especially for Ellen and Jane (introverts) because they have a special talent in music. They can be the music authorities while en route. Take some brief notes if you wish about important observations you want to mention later. Ready? The wagon is about to leave. Get your pillows! Bob and Gary transfer us to the year 1870 and to the wagon in Illinois."

The Action plans

1. I plan to start my action plans as soon as the film ends by saying, "I am very interested in discovering who among you have made some keen observations while traveling West!"
2. While working on the questions on the trip guide I plan to encourage my pupils to work individually and in groups on a number of additional activities that will call for the development of the understandings, abilities, attitudes and appreciations that constitute my teaching purposes or teaching unit outcomes. The activities are as follows:
 - (a) Make tape recordings of songs of the period.
 - (b) Construct dioramas showing life on the Great Plains or displaying contrasts to life in New England.
 - (c) Write letters describing some of the emotions the pioneer must have experienced.
 - (d) Make a model of a sod house for the school library.



- (e) Make a pictorial chart arranged chronologically which illustrates pioneers of various kinds in various periods of history.
- (f) Make illustrations that define new terms.
- (g) Construct salt and flour maps which emphasize topography.
- (h) Use reference books in the school library to find answers to good research questions raised by pupils.

ANALYSIS OF CASE STUDY NUMBER 5

It should be noted that important questions were introduced in the *readiness* plan and that these same questions (as a trip guide) became the first order of business when the film journey was ended. It should be noted also that after the film showing was over that new projects were to be identified and worked on by individuals and groups.

Ordered Sequence of Responses

1. Refer to the listing of the teacher's purposes, Sample 1, stated earlier in the chapter, and observe the relationship of the questions and projects to the understandings, abilities, attitudes, and appreciations.
2. Is it not then for the teacher to decide how to develop optimum readiness? Does it not seem quite correct to say that this film served as an introduction to a teaching unit? Could not the problem section after the film have been expanded to involve more media such as films, filmstrips, tapes, maps, and globes? Some used by the teacher, others used by pupils in reports, etc.?
3. Do questions raised during the readiness phase constitute a *main problem* in the same sense as Case Study Numbers 1 and 2? Was any one of the questions in the trip guide broad enough to consume the energies of the entire class? Were the projects in the *action* plan large enough to demand the cooperative work of groups of pupils? Is it not correct to say in general that when a larger number of questions is used, everyone works on all of them, and when one large problem is raised everyone works on at least a part of the whole problem, that is, contributing in some way to the final completion? If a large number of separate projects are assigned or formulated by the class

Figure 4-8. In Case Study Number 5 a motion picture is again, as in the previous case study, used as a film journey back into the days when people trekked West. These views indicate how the film, through its realistic enactments of historic events, can open up new problems for class groups and individuals. These views are from the film, *Pioneers of the Plains*. See also Figure 4-1 in connection with the Sample 1 statement of teaching purposes. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)

then is it not proper for the class to be split up into groups each completing and possibly reporting on its separate assignment?

4. Is it not frequently necessary to use technological materials and devices in combination? Additional materials like maps, filmstrips, slides, and tape recordings for additional presentations?

Case Study Number 6

This next case study is unconventional in nature. It emphasizes the processes of:

1. Organizing pupils in vastly different ways for specific learning activities. The particular emphasis is upon individualized instruction through specially prepared materials.
2. Selecting audiovisual materials for use by individuals subjected to control by devices and materials.
3. Preparing unique self-teaching materials in the form of mimeographed guide sheets and self-teaching sequences.
4. Guiding the reactions of various groups along desired paths of progress by remote control, that is, by means of audiovisual materials in conjunction with programmed sequences of question and answer sheets, textbook references, and special project work during free time.

For details of this case we turn to an unpublished doctoral dissertation¹⁷ describing a research experiment that pitted two methods for teaching an eighth-grade unit in the social studies against a control group. Pertinent excerpts are selected and arranged in this presentation for the purpose of showing how the design, even though vastly different in operation, follows the five basic principles presented in Chapter 3, and how technology facilitates the guidance of pupils by unique methods in a regular classroom teaching situation. It should be borne in mind that this case study is a part of a rigidly controlled instructional experiment and therefore it is not presented as a recommended model to be followed in every detail. In a normal situation, many other materials as valuable adjuncts might be used with pupils in larger groups, with the teacher playing a greater part in face-to-face guidance of pupil responses, at least during a part of the class period. The reader may be interested to know that the self-instruction methods represented in this case study seemed to the researcher to produce as much of the learning measured by the

¹⁷ By permission of George E. Ingham, "Comparison of Two Methods of Self-Instruction in Teaching a Unit in Social Studies" (Unpublished Ph.D. Dissertation, The University of Connecticut, 1962), pp. 189-512.

achievement tests as the conventional methods employed in the control groups.

PLAN FOR USING A COMBINATION OF PROGRAMED LEARNING, INDIVIDUALIZED USE OF FILMSTRIPS, AND TAPE-RECORDED INSTRUCTION

Class Relationships

For an eighth-grade class in Social Studies. The teaching unit was titled *Uncle Sam Enters Manhood*. Eleven specific topics served as focal points around which broadly stated problems and specific questions were listed. The eleven topics¹⁸ were: "(1) The United States Engages in 'Dollar' Diplomacy, (2) Causes and Results of Building the Panama Canal, (3) The United States Interferes in the Affairs of Latin America, (4) Industrialism, Nationalism, and Imperialism Begin to Arise in Europe, (5) The Results of Sarajevo, (6) Uncle Sam Walks the Tight Rope, War or Peace, (7) Uncle Sam Goes to War, (8) The Versailles Treaty, (9) The League of Nations, (10) The Flaming Twenties, and (11) Depression Threatens the World."

The Selection Principle in Action

Teaching Purposes. In this instructional design the objectives are stated in a list for the entire teaching unit, and presumably all materials and processes were selected to achieve those objectives. Excerpts from the list showing understandings, abilities, attitudes, and appreciations follow:

4. The United States has passed through an agonizing period of growing up.
 - (a) One of our first unhappy experiences with foreign countries resulted in the Spanish-American War.
 - (b) Central and South American nations were angry because of the means by which the United States acquired the land for the Panama Canal.
 - (c) American citizens got their first real *baptism by fire* under comparatively modern practices, during World War I.
 - (d) The United States antagonized the Allies by failing to join the League of Nations.
 - (e) The depression starting at the close of the 1920's subjected the United States to a period of heartbreak and soul-searching.
 - (f) Because, on occasion, the United States seems to act foolishly, the reaction of other nations toward the United States is adverse.
8. Extravagance can lead to economic disorder.
 - (a) The depression which started in the late twenties followed a period of wild spending.
 - (b) World War I was succeeded by a recession.

¹⁸ *Ibid.*, p. 255.

(c) The "Great Depression" proved the old saying that "Whatever goes up must come down."

1. The ability to judge whether political decisions on the international level are more democratic and liberal or totalitarian and reactionary in nature.
2. The ability to discover causes of world events today.
3. The ability to find the facts underlying the reactions of other nations towards acts of the United States.
4. The attitude of concern for wise and humanitarian international leadership.
5. The attitude of criticalness.
6. The attitude of helpfulness.
7. The attitude of responsibility.
8. The appreciation of democratic action.
9. The appreciation of clear thinking.
10. The appreciation of courageous action.¹⁹

Selection and General Use of the Self-Instruction Materials. Twenty filmstrips were selected, and a pupil-response sheet for each filmstrip was prepared. Students used individual filmstrip viewers inserting the strips themselves and carrying on the viewing and responding activity as directed by the sheets, frame by frame. About ten such viewing devices were in the classroom and groups of pupils took their turns. Four prerecorded tapes were made by the researcher for use by teachers of the experimental groups. For each tape, a pupil response sheet was prepared that called for filling in blanks and carrying on certain map analysis activities as well. In addition a 295-item programed learning sequence in the form of a linear-type scrambled booklet was prepared, which each pupil was asked to complete as soon as steady work would permit. Each pupil received a *Learn By Yourself Kit*, so named by the researcher. Two different kinds of teacher activity accompanied the employment of the materials in their experimental use. Some classes of pupils had no direct teaching or counsel at all. In this case the teacher was simply present as an organizer of pupils, devices, and materials, explaining nothing having to do with subject content. In other classes the teacher served as an organizer as just stated, but also held small group conferences for tutorial purposes.

Excerpted Materials. Two of the self-instructional sheets, one for a filmstrip and the other for a tape recording, and some sample items of the programed learning sequence should now be examined by the reader.

ONE OF TWENTY FILMSTRIP WORKSHEETS FROM THE LEARN BY YOURSELF KIT²⁰

Name _____

Number Right _____

¹⁹ *Ibid.*, pp. 189-191.

²⁰ *Ibid.*, pp. 316-320.

Social Studies—Grade 8

UNCLE SAM ENTERS MANHOOD

Work Sheet #12

This work sheet is to be used in connection with the filmstrip: *The First World War* (27 frames—color—Eye Gate—1957)

PROBLEM:

As you have learned from your reading, wars are always dreadful and affect not only those whose profession is fighting but often many innocent citizens. Through the centuries man has made war on his fellow man and, although the cause may have seemed to be high-sounding, generally the basic reason has been economic and selfish. World War I was no exception. This was the most terrible and far-reaching war man had known. In it were involved many nations and because of it many people suffered and died. Why was this war fought? Were economic reasons behind it? What new devices for fighting and killing were used in it?

LOOK FOR THESE IMPORTANT POINTS:

1. The underlying reasons for World War I.
2. The nations making up the Allies.
3. The nations making up the Central Powers.
4. The then new methods of war.

DIRECTIONS TO HELP YOU ANSWER QUESTIONS BASED ON THE CONTENT OF THE FILMSTRIP:

Observe each frame of the filmstrip carefully. Examine the illustration in detail and read the caption thoroughly. Draw conclusions from the information offered. Study the problem and note the important points. After viewing each filmstrip frame, write, in the space indicated, the answer which seems best. After you have done this, check yourself for the correct answer which will be found, printed upside-down, folded under, on the right hand side of the paper. At the top of the front page of your work sheet, write the number of your correct answers. If you were completely correct, you will have 28 right. Discover for yourself why you were wrong when you made incorrect replies. Learn the correct replies.

- | | |
|--|----------------|
| 1. Frame #1—In June of 1914, the Archduke of Austria-Hungary was assassinated in the town of Sarajevo in Serbia. This murder at _____ was the spark which set off World War I. | Sarajevo
1. |
| 2. Frame #2—Austria-Hungary, encouraged by Germany, therefore declared war on _____. | Serbia
2. |
| 3. Frame #3—Russia was Serbia's ally. Troops were immediately mobilized on the borders of _____. | Russia
3. |



Figure 4-9. These eighth-grade students are hard at work on their *Learn by Yourself Kit* filmstrip viewers and accompanying work sheets. (Courtesy Board of Education, Westport, Conn., and George E. Ingham.)

- | | |
|---|---|
| 4. Frame #4—France called up her army since, by treaty, she had to fight if _____ did. | Russia |
| 5. Frame #5—Since Germany had urged Austria-Hungary to declare war on Serbia, she immediately declared war on the two allies, _____ and Russia. | France |
| 6. Frame #6—Germany promptly attacked _____ by invading Belgium. | France |
| 7. Frame #7—Because of this invasion, the war spread when Great Britain declared war on _____. | Germany |
| 8. Frame #8—The Allies now were made up of _____, _____, and _____ and the smaller nations fighting with them. | Russia
France,
England,
Britain or |
| 9. Frame #9—The Central Powers included Turkey and Bulgaria as well as _____ and _____, both of which had been originators of the war. | Hungary
Austria-
and
Germany |
| 10. Frame #10—Italy, originally bound by treaty to Germany, did not fight on her side but joined the group of nations known as the _____. | Allies |

11. Frame #11—The basic reason for the war was economic. Germany had always wanted to get control of the nations in southeastern _____.
Europe
11.
12. Frames #12, #13—Germany wanted to build a railroad to the Near East so that she could establish new markets for her products in the _____.
Near East
12.
13. Frame #14—By means of this railroad, oil and other valuable materials for maintaining an industrial society could be brought back to _____.
Germany
13.
14. Frame #15—Germany also wanted to take the Suez Canal from England so that the rich markets of India would be cut off from _____.
England
14.
15. Frame #16—Germany hoped that, if she were victorious in this war, she might build an empire by obtaining many _____.
colonies
15.
16. Frame #17—In the first years of the war, Germany was highly successful and drove the English and French armies back as far as the Marne River in _____.
France
16.
17. Frames #18, #19, #20—After this, the opposing armies settled down to trench warfare with neither side able to win a decisive _____.
victory
battle or
17.
18. Frame #21—Both warring groups of nations, the _____ and the _____, needed to have supplies of food and war materials shipped to them from overseas.
Powers
and Central
Allies
18.
19. Frames #22, #23—The English navy was used to blockade German ports and to sink _____ merchant ships.
German
19.
20. Frame #24—Germany's reply to this was to use her submarine fleet to sink _____ supplying the Allies.
boats
ships or
20.
21. Frame #25—Poison gas, the most terrible weapon of its time, was developed and used during the _____.
war
21.
22. Frame #26—Tanks were first used as weapons of _____.
war
22.
23. Frames #27, #28—Appearing for the first time for purposes of war was the _____, primarily used for scouting.
airplane
23.

SUMMARIZATION:

The main problem for this Work Sheet emphasized that all wars have been dreadful and have left their mark on those actively involved as well as on civilians. Generally, war occurs for economic and selfish reasons. World War I was no exception. It involved many nations, it was the most terrible and far-reaching of its time, and had the highest casualty list of any war fought up to the early Twentieth Century. Why was this war fought? Were economic reasons behind it? What new devices for fighting and killing were used in it? Go over your answers to the questions above and on the bottom and/or back of this sheet write a paragraph or two, summarizing the answers to these three questions.

ONE OF THE FOUR TAPE WORK SHEETS FROM
THE LEARN BY YOURSELF KIT²¹

(Note: The recorded tapes were presentations calling for immediate, constructed answers by pupils.)

Name _____

Social Studies—Grade 8

UNCLE SAM ENTERS MANHOOD

Work Sheet #4

This work sheet is to be used with Tape #4—*The Flaming Twenties*. (7½ IPS—27 minutes)

PROBLEM:

This tape will briefly tell you a little of the story of the 1920's, one of the wildest periods in Uncle Sam's life. You will learn that as one privilege was taken from the American people, another took its place. The new industries that arose and boomed in the early Twenties and their effect on the life of Americans will be described. You will also be given a glimpse into why the 1920's were called "The Flaming Twenties." What changes in their ways of living did American soldiers find when they returned from Europe? What great industries boomed in the early Twenties? Why were the 1920's such a wild period?

QUESTIONS BASED ON THE CONTENT OF THE TAPE RECORDING:

As you listen to the recording, there will be certain directions and questions for you. These will be in reference to this work sheet. Follow the directions as you receive them and write your answers on this work sheet, as the tape tells

²¹ *Ibid.*, pp. 511-512.



Figure 4-10. This section of a class group is shown listening to special tape-recorded presentations that also called for participation by pupils in constructing responses. The correct answers were given after short pauses in the tape commentary to permit students to check the correctness of their work. Looking at the rear of the tape recorder, the white cord is the power supply cord, and the jack below and to the left of the power plug is the external speaker jack (may be used also as in this case for the aggregate box) to which all the headsets are connected. (Courtesy Board of Education, Westport, Conn., and George E. Ingham.)

you. Review what you have written when the tape indicates what your answer should be. Find out for yourself why you were wrong when you answered incorrectly.

1. What was the Amendment, popularly called Prohibition? When was it approved? What were its provisions?

2. Are there bootleggers operating in the United States today? Is liquor still being manufactured illegally?

3. What important right of citizenship was given to women who could qualify? When did this take place?

4. Other than radio, what new industry boomed after the war? What was the effect of this industry on one already in existence?

5. What new advantages were there for the small family and for the householder after the war? How was life improved for the small family and for the householder?

6. What improvement in communications was made in the 1920's? Did this have any effect on entertainment?

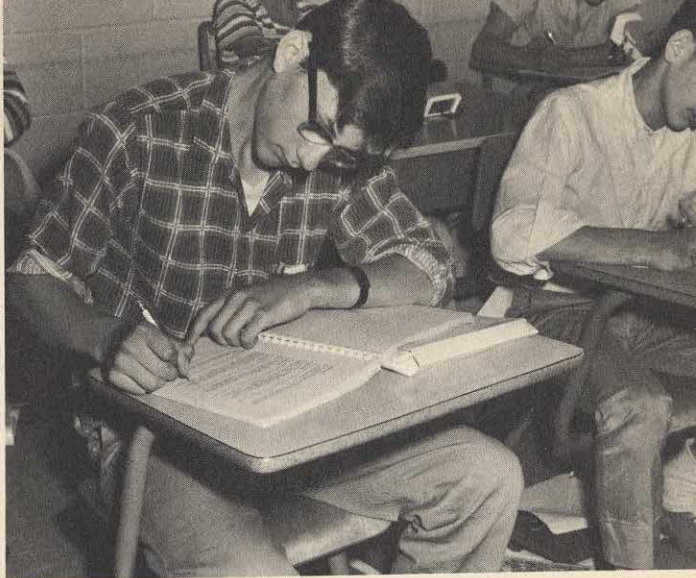
7. What was the effect of the 18th Amendment on the American people in the 1920's?

8. What does it mean to declare a moratorium on the payments of debts? Why did Uncle Sam declare a moratorium for foreign nations?

SUMMARIZATION:

In this tape you have been told a little of the story of the 1920's. You discovered that, as one privilege was taken from the American people, another took its place. New industries that arose and boomed in the early Twenties were described. You also were given a glimpse into why the 1920's were called "The Flaming Twenties." What changes in their ways of living did American soldiers find when they returned from Europe? What great industries boomed in the early Twenties? Why were the 1920's such a wild period? On the bottom or on the back of your work sheet, write a paragraph or two, summarizing the answers to those questions.

Figure 4-11. In this picture several pupils are shown as they worked item by item through their programmed booklets. (Courtesy Board of Education, Westport, Conn., and George E. Ingham.)



SOME SAMPLE ITEMS FROM THE PROGRAMED
BOOKLET OF 132 PAGES ON THE TOPIC,
THE THREAT TO WORLD PEACE²²

(Note: The items are shown consecutively here instead of being arranged as in the text originally with item and answer appearing on succeeding pages.)

Topic Four

THE THREAT TO WORLD PEACE

Item #108

Imperialism and nationalism are apt to be partners. Nationalism is the doctrine that states that the interests of one's country are more important than international considerations. If the philosophy of a nation's leaders is imperialistic, it will also be _____.

Answer to Item #108

nationalistic

Item #109

"Militarism" is the glorification of the ideals and attitudes of the professional soldier and the policy of maintaining powerful armed forces for instant use. Aggressive preparedness is _____.

²² *Ibid.*, Items #108-#115, pp. 414-429; Item #144, pp. 428-429; Item #295, pp. 496-497. 191

Answer to Item #109

militarism

Item #110

Imperialism, nationalism, and militarism usually go hand in hand. To what policy must a country's leaders subscribe in order to further the cause of imperialism and nationalism? _____

Answer to Item #110

militarism

Item #111

Militarism needs industrialism. Industrialism is a social and economic organization indicated by machine production, assembly line techniques, and concentration of workers. What is the basis for militarism? _____

Answer to Item #111

industrialism

Industrialism is necessary for peacetime activities, too.

Item #112

Can you think of a country in Africa whose leaders are both nationalistic and militaristic and who are showing a tendency to imperialism? _____
What is the country? (As a clue, the country was once ruled by a famous queen.) _____

Answer to Item #112

yes

Egypt

If you missed on the second part of this, the queen was Cleopatra.

Item #113

If a small boy walks around ready to fight to protect what he considers to be his interests, what is he practicing? _____

Answer to Item #113

militarism

This is "a chip on the shoulder" attitude.

Item #114

As new, independent nations are created out of former colonies, what charge is frequently made against the West by the Iron Curtain countries in the UN?

Answer to Item #114

imperialism

Item #115

Could the charge of imperialism be made against any of the Iron Curtain countries? Your answer will be your own opinion but should be based on fact.

Answer to Item #115

As stated previously, your answer is your own opinion. Did you base it on fact?

Item #144

The balance was bad, though. If nations on either side became involved in war, all nations, because of their treaties, would also go to war. This would destroy the _____.

Answer to Item #144

peace

This concludes topic four—"The Threat to World Peace." Go back and review what you have learned before proceeding to Item #145 which begins topic five—"The Great Melting Pot," on page 65.

Item #295

It is only fair in a democratic society that all citizens in good standing have the same privileges and responsibilities. In many instances, the vote of

_____ has been a deciding factor in an election.

Answer to Item #295

women

Congratulations! You have completed topic nine—"New Laws of the Land" and, with it, the requirements of your self-teaching workbook. Read the last section in your activity guide for special instructions for review of the material you have just covered.

The Readiness Principle in Action

The pupils' *Learn By Yourself Kit* was complete with motivational material, and the teacher had introduced the teaching unit before distributing the kit. The pupil was led from general motivational material to specific problems in each guide sheet, and the programed booklet was also introduced to the pupil in an appealing preface. Each of the work sheets may be scrutinized for readiness-building elements. The reader is certain to find problems and questions at every point throughout the material. Points to look and listen for are stated, and a challenge seems obvious. Motivational material in the preface of the programed booklet is a good example of the way special readiness material may be prepared and presented to pupils. The quotation follows:

THE PROGRAMED BOOKLET PREFACE ²³

Preface

As a teenage citizen of the United States, you enjoy certain privileges found only in the democracy in which you live. With these privileges, however, go certain responsibilities—to your family and to your friends, to your church and to your school, to your community and to your nation, and—to yourself.

Are you an active participant in family affairs? Do you help your parents, your brothers and sisters, and your friends? Do you work for the good of your church, your school, your community, and your nation? Can you make good judgments? Do you listen to both sides of the story before forming an opinion? Can you tell good from bad, right from wrong? Are you considered to be a fair and wise leader in your group or are you a good and loyal follower? Both are needed, you know. And what does all this have to do with this "Self-Teaching Workbook?"

As the title implies, this is a guide for your work. "Workbook" means just that—work. If you work on it carefully, you will learn from it. You should be able to arrive at worthwhile conclusions and to form your own opinions, based on fact and not fancy. It will be your responsibility,

²³ *Ibid.*, p. 363.

as an individual student in your class, to do this work by yourself and at your own speed. By so doing, you will be gaining additional experience in the assumption of responsibility as a teenage citizen now and as an adult later. In short, you can expect to be an even better citizen than you are now.

Directions as to procedure to follow are on the next page. Read them carefully and then begin when you understand them completely. Remember—it's your responsibility! You are on your own!

Certainly pupils may be made ready for study and response activity in many and unique ways. Some of them may involve words in print, others may involve a lecture, illustration, or a question raised by pupil or teacher.

The Action Principle at Work

An examination of the guide sheets and programed text material is certain to reveal a potential for a maximum of response activity for each minute of class time. Problems and questions were clearly stated, and these questions and responses provide not only significant readiness-building material but they also constitute the basic activity that pupils need to engage in to learn in terms of the teacher's objectives. Thus the newer technological devices and processes may be used under the guidance of the basic principles that have operated in the more conventional classroom situations depicted in the other case studies.

ANALYSIS OF CASE STUDY NUMBER 6

It is the teacher's responsibility to make good decisions about materials and devices, and about how best to fit them into an effective instructional design to achieve valid objectives. Case Study Number 6 reveals a teacher at work in a situation where she was assumed by pupils to have prepared a phenomenal array of self-teaching materials, and what remained was to offer them to pupils, and expedite their use with little if any face-to-face verbal activity. The following sequence of questions will assist the reader to analyze this case study for the purpose of developing insight into what constitutes effective planning and utilization of audiovisual technology in what may be called unconventional patterns.

Ordered Sequence of Responses

1. Name some differences in basic teaching methods between Case Study Number 6 and the other case studies. As to the degree of "speech" control by the teacher? Freedom of pupils to make progress? Control and guidance of pupils by written instructions?
2. What should the teacher do about the pupils who finish self-instruction materials first, thus having free time? (Make sure your responses are valid.) Also see Item 4.

3. How could motion pictures have been put to work in this case study? In the introductory phase? Used with *readiness and action* guide sheets?
4. Does it appear that pupil activity was geared more to the learning of subject matter? Read the statement of abilities, attitudes, and appreciations again, and ask yourself if other significant problem-solving activities should have supplemented the activity with self-teaching materials in optimum balance? How could work in the library help? Surveys? Interviews?
5. Identify the elements of readiness in the samples of self-teaching sheets. Note the pupil problem focus. Note the directed observation items and the directions for procedure on the first section of the filmstrip Work Sheet #12.
6. Note the required written response blanks and the request for a written summary at the end of the work sheet.
7. What determines (or should) the nature of the responses that pupils need to make? Study some of the called for responses in the filmstrip and tape guide sheets and the responses to the programed text items and determine the nature of the objectives involved.
8. What similar, though not as formal and prolonged, self-instruction activities could teachers develop for use with a film, a filmstrip, a tape, a chart, or transparency? Problems and response processes or illustrated guide sheets? Have simple guide sheets and special reference material been prepared by good teachers for many years, that is, long before the term *automated teaching machines* was ever used?
9. Do you recognize that the excerpts in this case study constitute, if all elements were included, a teaching unit? Do you perceive that several media were employed? Note the two roles of this teacher: the creator of the unique teaching materials, and the manager of the day-to-day situation? Note also the role of motivator and communicator.

Case Study Number 7

More simple to organize, prepare, and operate than the learn-by-yourself package in Case Study Number 6 is a system for using taped instruction and illustrated work sheets as an integral part of teaching in a conventionally organized classroom. A series of pictures will tell the story of the operation, and a set of questions will direct attention to relationships between tape, response sheets, and other class activities.

THE USE OF TEACHER MADE TAPES²⁴**The Class and Teacher**

This Case Study deals with a group of fourth-grade elementary school pupils in the Burr Farms School being taught in this instance by instructional tapes prepared by the teacher. The subject is science, and the specific topic is *Structure of Green Plants*.

Relationship of the Taped Instruction to Teaching Objectives

As in the other case studies it is necessary to take note of the objectives that pupil activity was designed to achieve. The following statements of purpose are based upon a personal interview with the teacher, the content of the pre-recorded tape, and personal observation of the activities of the pupils during a visit to their classroom. The teaching objectives follow.

UNDERSTANDING THAT:

1. Scientists who study plants are called botanists.
2. Most of the plants in home gardens are green seed-making plants.
3. The main parts of a plant are the roots, stem, leaves and blossom, and each has its own special job to do.
4. There are three kinds of roots: trunk roots, feeler roots and root hairs. The coarser roots carry the dissolved food picked up by the root hairs up into the plant. Coarser roots also hold the plant upright and firmly in the ground. The food picked up by root hairs is in the form of minerals dissolved in moisture in the soil.
5. Root systems of plants are very complex and when the length of all roots in the ground are added together, the total distance may be many feet, even miles.
6. Stems of plants move liquids from one part of the plant to another, they hold plants up toward the sun, and they are able to produce leaves.
7. Without the leaves of plants we and many other animals would go hungry.
8. Leaves are the food making factories of a plant and this whole process is made possible because they are able to make chlorophyll. Leaves take in carbon dioxide from the air and give off oxygen when this food making process is going on. Leaves also have veins that carry food made in the leaves to other parts of the plant, even to the roots.
9. Leaves are made up of cells some of which act like doors through which leaves breathe. These little breathing cells are called stomata.
10. Plant blossoms or flowers produce seeds from which new plants may grow.

²⁴ Westport Public Schools, Westport, Connecticut, Dr. Gordon Peterkin, Supt. of Schools; Burr Farms Elementary School, Leonard Metelitz, Principal; Louise M. Whaley, Director, Instructional Materials Center; Annette Fournier, Teacher and tape producer.

ABILITY TO:

1. Make accurate observations.
2. Keep correct records.
3. Draw conclusions from facts.
4. Solve problems.
5. Find needed information.

ATTITUDE OF:

1. Curiosity.
2. Openmindedness.
3. Objectivity.

APPRECIATION OF:

1. Accuracy.
2. Reliable data.
3. Opinions based on facts.

Relationship of Taped Instruction to the Larger Teaching Design

It is also important to know just how this particular use of technology was related to previous classroom activity. We have already observed the valid teaching objectives. We need now to note that (1) the taped instruction activity was related to a stream of pupil activity, that is, it was not just superimposed as an end in itself, but rather was tied to other projects and pupils' needs, and to action plans for a particular science period; (2) pupils had been made ready for this activity by planned teacher activity; and that (3) the taped instructional experience would achieve the specified objectives directly, or make a predicted contribution to their accomplishment.

Relation to Pupil Action: Past and Present

Pupils were at work on a teaching unit, the topic for which was *Plant Life*. Each pupil a number of weeks previously had started a plant experiment. Seeds had sprouted and plants were growing. Some of the plants were being grown in water, for comparison with plants grown in soil; some were kept cool, others were being grown under an opaque paper cover. These experiments intrigued the youngsters and they discussed each other's observations. The class had made two displays for the bulletin board, one was a labeled diagram of the parts of a flower, and the other on the parts of a plant. New facts were needed. Pupils were ready for deeper insights as they worked together on their projects.

The instructional tape, requiring approximately twenty minutes, provided a direct presentation by the teacher. The class was divided into two groups for the presentation, one group was assigned to the tape-listening work tables, and the other group was called together by the teacher, who had planned to give pupils a chance to observe seeds under the available magnifying glasses. The teacher directed this activity personally and also provided guidance for

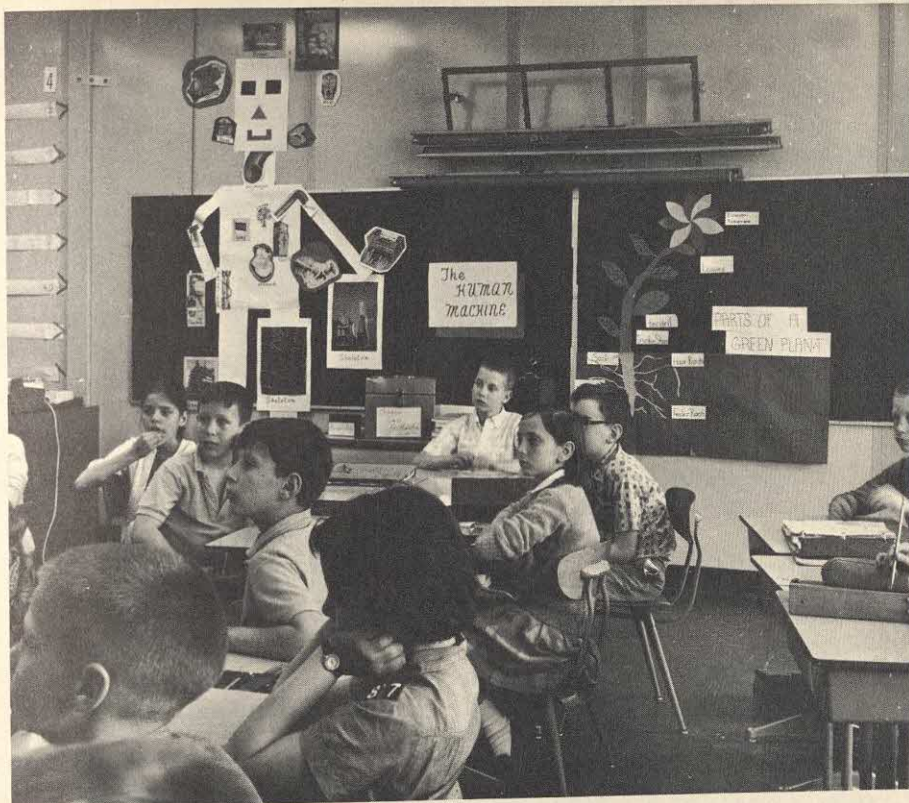


Figure 4-12. Members in this fourth-grade science class are listening to their teacher's introduction to the multi-group activity for that session. This is how youngsters react to a good readiness plan. Evidence of individual and group activity is everywhere. A work table covered with pots and pans containing individual plant-life experiments is out of the picture at right near the window wall. Only a portion of the class is in the picture. Note the two boxes on the table near the chalkboard. The larger one is labeled *Spare Time Arithmetic* and the small one is labeled *Answer Box*. The intrusion of the author and his camera disturbed their basic attention patterns to only a minor degree. (Courtesy Board of Education, Westport, Conn. Photographed by the author.)

on-the-spot textbook reference work. When the two groups exchanged places on schedule, the teacher repeated her demonstration and observation session, working closely with the pupils.

The Readiness Plan of the Teacher

The pupils were basically ready for more advanced work on the structure of green plants because of their continuing class activity, but, at the beginning of this session, the teacher, in the opening minutes, explained the nature of the plan of activity for the day. She tied the presentation on tape to her concurrent demonstration and the pupils' observation of seeds. She also explained how the pupils were to study the work sheet diagram during the listening session. She mentioned the experiments now in process, and how the tape contained valuable information that would help them to understand better some of their observations and findings.

Contribution to the Teacher's Objectives

In discussing the contribution of the tape to the achievement of teaching objectives the teacher emphasized that the tape and work sheet presented the vital information pupils needed in carrying on their class work. The teacher also believed that her own voice on the tape actually allowed her to be in two places, doing two different teaching jobs at the same time. Another point was that an audio presentation permitted the presentation and development of science concepts by some fourth-graders who were as yet unable to comprehend such material in regular reading references or encyclopedias. The information thus gained through explanation enabled pupils to extend their factual basis for making keener observations and judgments.

The Technological System in Operation

In this case study the first point for observation is that the teacher prepared her own instructional tapes and work sheets and decided how best to relate them to the curriculum. First we present the audio content on the tape in the form of the tape script.²⁵

SCIENCE #17—GENERAL STRUCTURE OF TYPICAL GREEN PLANT

Hello boys and girls. Have you been discovering how many things there are to learn about plants? Well, we've really just begun—there are ever so many fascinating and exciting things still to learn and do.

With so many thousands of plants growing on earth, it is impossible for any one person to know them all. Yet a plant scientist, who is called a botanist, can often look at a strange plant and tell what plant family it belongs to. How does this scientist classify a plant he has never seen before?

The answer is structure. The botanist looks at the parts of a plant and how they are put together. He studies the structure of the stem, the leaves, the flower, and the roots, and finds clues in each one. Putting all the clues together, he can often place the plant in the family group to which it belongs.

The first thing he must do is place the plant in one of these two groups:

1. plants that make seeds
2. plants that do not make seeds

The botanist knows many things about each plant group. Therefore, finding the right group allows him to learn many things about each plant.

Let us assume that our botanist has decided that the plant in question is a seed maker. Although there are countless numbers of seed making plants, there is much information that is true of all of them.

Today, then, let us look at the structure of a typical, green, seed-making plant to see what we can learn about it.

Most of the plants in our gardens at home fall into this category. Some are low and bushy like pansies and others are tall and straight like hollyhocks or

²⁵ Tape script and tape were produced by Miss Annette Fournier, fourth-grade science teacher, Burr Farms Elementary School, Westport, Connecticut.

delphiniums. They produce flowers in all sizes and colors but all are green, seed-making plants.

Look at Page 1 of your work sheet now. Here you will see the drawing of a typical, green, seed-making plant. Study the drawing as I tell you about it. The main parts of a plant are the roots, stem, leaves, and blossom. Each part has a very special job to do and our work today will be to discover exactly what each section of the plant has to do.

We have said that this is a seed-making plant. Therefore, we know that its life began when a seed was planted. When you plant a seed, you really plant stored up food, because the seed has within itself, the energy (which means strength or force) for growth. When it is first placed in the soil, the seed takes in water equal to half its weight. As it begins to grow, the seed uses the food that is stored inside it. And the soil helps in the growth of the young seedling by supplying minerals and water.

As the seed grows, the roots develop and spread through the soil bringing food to the hungry plant. But how does the plant get this food from the soil.

Tiny hairs, called root hairs, grow from the finest roots when they are beginning to sprout. These root hairs grow into the soil and take in food that has been dissolved in water. They have no holes or openings, so solids cannot enter. But liquid food can pass through the very thin tissue. From the root hair, the food is carried inside the plant.

Root hairs do not grow on the larger, coarser roots, so these roots do not take in food for the plant. It is the job of the bigger roots to carry the food up to the plant after it has been taken in by the root hairs.

In addition to getting food and sending it up into the plant, the roots also hold the plant firmly in the ground and allow it to reach up into the air towards the sun. You probably know that when plants are knocked down and lie along the ground, that they soon die and rot.

It is interesting to note that roots of common garden plants are really quite long and involved. The root system of a single cabbage plant may spread through as much as 200 feet of soil. That of a common tomato plant may be much more. The total length of the root hairs of a winter rye plant may be more than 5,000 miles! Roots then are pretty important parts of a plant and are surely amazing things themselves.

Before we go on to examine the rest of the plant, let's stand up and stretch for a moment. (30 sec.)

Ready? We have learned about the roots of plants and the next important part to consider is the stem. We are quite familiar with stems. We know that if we cut a stem, the flower and leaves above the cut, will wither and die. We know that if you put the end of the stem in water, the flower and its leaves that have been removed from the parent plant will not wither so quickly. This is because the stem is able to get water to the leaves and to the flower and keep them supplied with at least some of their needs.

From this, we know that one of the uses a plant finds for stems is that of moving liquids from one part of the plant to another. The stem also holds the plant up toward the sun and is able to produce leaves.

Leaves do some of the most important work in the world. Without them

you and many other animals would go hungry. Leaves contain a green coloring matter called chlorophyll. If there were no chlorophyll, you could not live. No other animals could live either. Scientists are trying to do the work that chlorophyll does by experimenting with chemicals, but so far they have had little success. Only a plant can make the wonderful chemical, chlorophyll. The whole process that uses chlorophyll is so involved and so important that we will not go into it today. For now, it is enough to remember that the leaves make this chemical, chlorophyll.

The most common kinds of leaves are broad and thin, and are arranged along the stems, usually near the tips. They are most commonly the greenest part of a flowering plant. Leaves, like stems and roots, are of many different kinds. Some are juicy and crisp like those of lettuce and others are tough and wiry like pine needles.

Each leaf is made up of millions of cells. We must use a lens or a microscope if we want to examine these cells. The plant breathes through some of these cells that are found on the underside of the leaf. These cells act like doors and are called *stomata*. "Stomata" means little mouths. The doors in the leaves can open and close. When they are open, air can go in and out.

We know that our own bodies take in oxygen from the air and breathe out carbon dioxide. Plants, however, do just the opposite. They take in carbon dioxide and breathe out oxygen.

In addition to the stomata, or little mouths, the leaves also contain veins. These veins transport the food that is made in the leaves, to other parts of the plant.

The last part of our plant is the blossom, or flower. We know that there are ever so many different kinds. They come in all sizes, shapes and colors and some have a very pleasant smell. The biggest job that a flower must do is to produce seed. And of course we know that seeds eventually produce new plants. But how is this done? What structure and organs do flowers contain that allow them to produce new plants? Because this is such an involved topic, we will work on it at another time and really explore the question fully. For now, it is enough to remember that a flower produces seeds which will then produce new plants.

Would you believe that we've only begun our study of the structure of plants? We still have much to learn about both leaves and flowers. But we did cover a lot of ground today, didn't we?

Many of the things that you have heard today, will be used again and again in class when we are performing our plant experiments.

Now I'd like to see what kinds of listeners we were today. On page 2 of your work sheet you will find an outline that lists the various topics that we have discussed today.

When you remove your earphones, fill in as many sections of this outline as you can. Bring it to class tomorrow and we will help one another to complete it. When it is finished you will have a handy reference page to add to your notebooks.

You may remove your earphones and begin working on your outline now.

We shall now turn to the observation of pictorial illustrations, Figures 4-13, 4-14, 4-15, and 4-16.

SUGGESTIONS FOR OBSERVING FIGURE 4-13

1. Did valid teaching purposes constitute the basis for this teacher's selection of this particular medium? What roles did this tape-recorded instruction play in assisting the teacher? (If you are not sure about the answers to these questions refer again to the preceding sections for explanation.)
2. Is this teacher to be admired for her ability to innovate?
3. Do you believe from your observation of the pupils that they were ready to participate in this activity? In other words, do you believe the teacher followed the second basic principle described in Chapter 3?
4. How is the control principle being carried out in this situation? What basic conditions have been met?
5. In this operation how are the tape and worksheet related? Can you identify the learning products?
6. How is the *action* principle being applied to the use of this tape?

Figure 4-13. *The Overall Classroom Activity of Students in Two Working Groups. One of the groups is at work with the teacher in a demonstration-observation session with seeds. The other group is getting instruction via a tape-recorded presentation with a diagram to illustrate some of the verbal content. (Courtesy Board of Education, Westport, Conn. Photograph by the author.)*





Figure 4-14. *The Simplified Arrangement of Instruments.* (Courtesy Board of Education, Westport, Conn. Photograph by the author.)

SUGGESTIONS FOR OBSERVING FIGURE 4-14

1. Note the convenient pipe-rack arrangement for storing the headphones, with headphones ready for use without loss of time.
2. Note simple headphone channel connecting to the tape recorder-player unit.
3. Does the worktable arrangement provide space for reference books and work sheet?
4. In this situation who would start and adjust the tone and volume controls of the tape player?
5. Note the simple connections for headphones and channel.

SUGGESTIONS FOR OBSERVING FIGURE 4-15

1. These pupils like this way of learning. They concentrate and work industriously. They listen, follow directions, and respond.
2. How much sustained activity of this kind would you as a teacher believe youngsters of this age might be able to undergo? How balance this presentation-response activity with other significant problem-solving activity? Project work and crafts? Library research and extensive reading?

Page 1 of the work sheet diagram is visible in Figure 4-16. This particular diagram for study during the tape presentation does not call for written responses by the pupils. Other diagrams in the series do call for such responses. Page 2 of the work sheet calls for students to fill in blanks summarizing the parts of a green plant and the roles those parts play in the life of the plant.

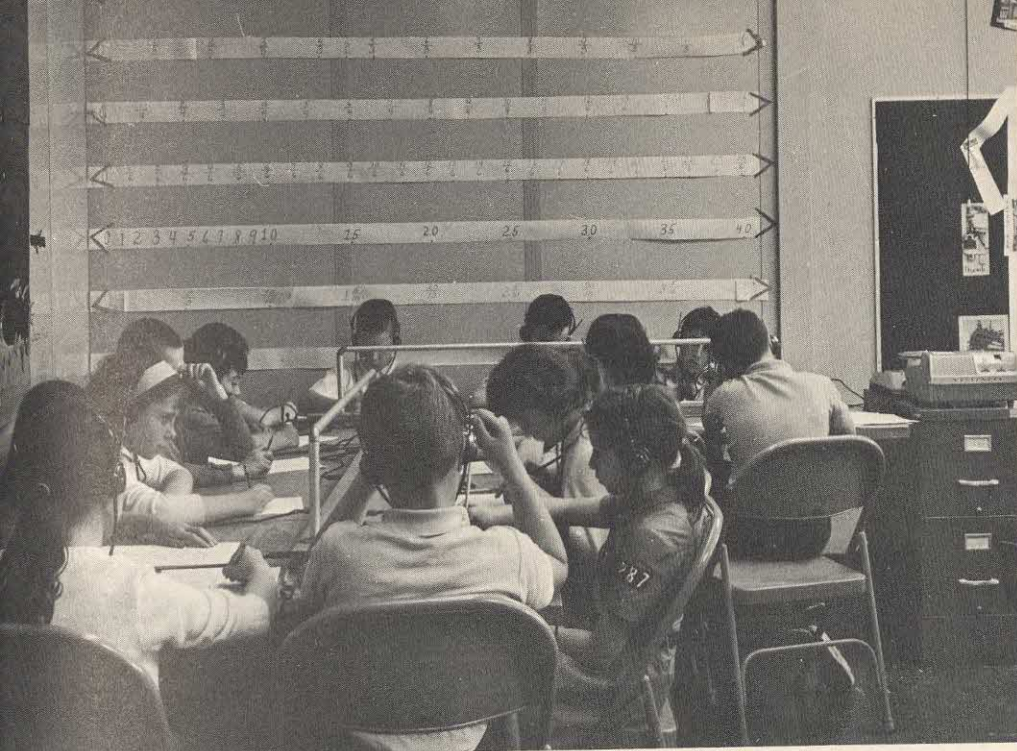


Figure 4-15. *The Pupils at Work.* In this segment of the class instruction is being given by means of a teacher-recorded tape. The teacher's own voice presents information and guides the students in their reactions, yet the teacher is actually nearby working with the other half of the class in a demonstration and discussion group. (Courtesy Board of Education, Westport, Conn. Photograph by the author.)



Figure 4-16. These pupils receive guidance from the teacher's commentary on the tape, hence the instruction is personalized. Could this kind of activity be carried on in large groups as well, provided, of course, ample instruments were available? Is the kind of mental and physical activity called for determined by the nature of teaching purposes? Is this kind of taped material easy to copy? Could textbook illustrations be effectively utilized as a reference base for taped instruction? (Courtesy Board of Education, Westport, Conn. Photograph by the author.)

ANALYSIS OF CASE STUDY NUMBER 7

We note in this case study that audio content prepared by the teacher could take many forms, such as direct explanations, step-by-step directions for carrying out a kind of performance, or directions for analyzing content of verbal and/or pictorial references, all prepared by the teacher, and perhaps all calling for some kind of a pupil answer, either whispered, written, or figured. In the light of the foregoing material the reader is urged to answer the following analytical questions or make the judgments called for.

Ordered Sequence of Responses

1. Based on the excerpts of audio content and the work sheet, which objectives would the taped presentation be likely to accomplish? What other routes to understanding does this case study reveal?
2. Is taped instruction a self-teaching activity? How could it be used for remedial work? Applied to spelling? To map work? To number concepts and computation? To science activities? To English expression? To reading activity?
3. What kind of teacher activity would be needed to get pupils ready for this exercise? (See discussion in Chapter 3, and previous case studies.) How do problems, projects, and extensive reading prepare pupils for action? Could an introductory sheet be prepared for readiness? Could a special introduction be included on the tape? Under what condition would an introductory talk by the teacher suffice?
4. Can response sheets of all kinds serve to get the necessary *action* by students?
5. Can tape-recorded instruction by the teacher serve to multiply the teacher's effort, that is, serve as an extension in time and place of the teacher's personality?
6. Could activity like this be carried on for one part of the class only, as one segment of valid multi-group activity? For example as remedial work? As special work for a group of fast-moving students?
7. Could teachers cooperate by working as a team to produce materials, or could each prepare separate units, according to agreed specifications, then exchange them, for example, prepare and donate one tape and get ten in return.
8. Is the work by the teacher to create such materials worthwhile? Economical because of subsequent repetition? Provide good basis for later revision?

Case Study Number 8

We now turn to a case study that focuses on the employment of devices and materials by a number of teachers working as a group called the *team*. While not forsaking for a moment the important and direct relationship between valid teacher purpose, namely, that of *means* and *ends*, we omit the statement of purposes and show only the nature of the devices, materials, and processes in such a highly systematized operation.

We therefore present a series of classroom pictures that show various aspects of teacher-pupil-technological relationships, especially in a large group of up to ninety pupils. We must point out that teachers may now, because of technology, extend their influence and control in new patterns of action.

EQUIPMENT, MATERIALS AND PUPIL GROUPS IN A TEAM-TEACHING SITUATION ²⁶

Team-Teaching Situation

The team-teaching situations shown in this case study are in a number of elementary schools where several teams of teachers are engaging in experimental work. The groups shown are taught by a team of five persons. One of these is a *team leader*, three are designated as *cooperating teachers*, and the other as the *teacher aide* with the rating of a secretary. These teaching teams plan their schedules, and work together in preparing materials and deciding on the design for large and small group activities to meet specific teaching objectives. A wide array of technological equipment and material is brought into use singly and in combination, such as taped instruction and work sheets, overhead projectors, motion pictures, filmstrips, displays, devices, television, and others. Thus the total enrollment of the large group is approximately ninety, and these pupils meet in large instructional spaces certain times during the day on a prearranged schedule, and, after instruction that lends itself to large-group presentation, this group divides into smaller groups of varying sizes for multi-group activity in the same or different classroom spaces.

Statements by Teachers

Several specific examples from language arts and science work at the elementary school level will help to portray the nature of the instruction

²⁶ Norwalk Public Schools, Norwalk, Connecticut. Dr. Harry A. Becker, Supt. of Schools, Mr. Bryce Perkins, Team Teaching Coordinator, Arthur W. Lalime, Director, Curriculum Materials Center.

being given by teams of teachers. We now turn to descriptions by the teachers themselves through the courtesy of *Grade Teacher Magazine*. The quotations are as follows:

QUOTATION NO. 1: LARGE-GROUP HANDWRITING

I have been using the overhead almost exclusively to teach my fifth- and sixth-graders how to write. First, and perhaps most important of all, I am assured that my whole group (usually eighty children) is progressing at the same rate; they are able to see exactly how their writing paper should look, line-for-line.

As for noting individual progress, I can, and often do, leave the machine to give help and offer suggestions; my cooperating teacher often does the same. All this is going on while the rest of the class is continuing with another area of practice.

Frequently during the lesson I call on children whose handwriting presents a special kind of difficulty to give us a sample on the overhead projector. This enables the class and me to analyze it and offer corrective criticism. They love to emulate the teacher!²⁷

QUOTATION NO. 2: LETTER WRITING

One day I wished to have total group instruction by reviewing parts of a letter and punctuation. Seventy-three children certainly would have a hard time seeing the chalkboard. The chalkboard also had to be used right up to the Language Arts period; therefore, I would waste time writing the letter during my Language Arts period. My teacher's aide made the transparency of the letter before the lesson. When it was time for English, the letter was ready. We reviewed the parts of the letter together, then the children came to the projector and corrected the letter.²⁸

QUOTATION NO. 3: INCREASING WORD ANALYSIS SKILLS

Tapes can be used for remedial purposes, to increase skills, for enrichment, follow-up activities, practice, reinforcement of known skills, and review. The tapes have been used in all the grades from second to sixth.

Through the use of tapes, we have touched upon every phonetic and word analysis skill. The tapes have been prepared with the intent to review and to reinforce all skills required in previous grades. Having accomplished these objectives, the child is better prepared to assimilate all new concepts. Therefore, all tapes are prepared in a series in order that the child may use a previously learned skill as a tool in learning his newly taught skill.

²⁷ By permission of *Grade Teacher Magazine*—"Teamwork Produces Audio-Visual Techniques," *Grade Teacher Magazine* (June 1960), pp. 55-58, 60-62, 64-72. The original statement was written by Josephine Mears of the Norwalk, Connecticut Public Schools.

²⁸ *Ibid.*, p. 57.

The children are given the opportunity to respond orally; for example, sounding out hard and soft consonants, blends, digraphs and long and short vowels. Each child is also supplied with a work sheet on which he responds individually to the tape. The work sheet is carefully prepared to afford the child an opportunity to use the given concepts as a tool while working on his own. This work sheet thus provides not only an opportunity to work with a given concept immediately after it has been presented, but also a clear picture of the child's achievement for that day for the purpose of teacher evaluation.²⁹

QUOTATION NO. 4: A LESSON ON SIMPLE MACHINES

As part of the Science curriculum in our school, I presented a lesson utilizing the tape recorder. This was done as a review follow-up exercise. To prepare this lesson, a script was written. After it was checked for errors, accuracy and time allotment, it was transferred onto a tape. The pupils were first introduced to the unit; the topic being "Simple Machines."

As part of the introductory work, I had prepared a transparency which helped greatly in the introductory phase. Following the introduction, which incidentally was presented to the total group of approximately 80 pupils, we distributed work sheets which graphically pictured the various simple machines. This was also used in conjunction with the taped lesson. The presentation included a film in addition to lecture, discussion and tape. For greater interest and understanding, two lessons consisted of demonstrations, these being actual examples of the simple machines. Also as part of these demonstrations, explanations were given by me in a rather detailed manner.

The tape, demonstrations, and use of film made an interesting unit, and the pupils were motivated. Results of tests indicated that the material was understood, not just memorized. The tape and transparency have become a part of the Curriculum Materials Center and are available to all teachers.³⁰

The Technological System in Operation

With these descriptions of actual operations by the teachers themselves let us turn to five picture panels beginning with Figure 4-17 for a visual presentation of technology at work. Each panel is accompanied by a series of suggested observations.

SUGGESTIONS FOR OBSERVING FIGURE 4-17

This picture shows a Norwalk teaching team in action, illustrating an instance of total group instruction:

²⁹ *Ibid.*, pp. 62, 64.

³⁰ *Ibid.*, p. 68. The original statement was written by Daniel Bardos of the Norwalk, Connecticut Public Schools.

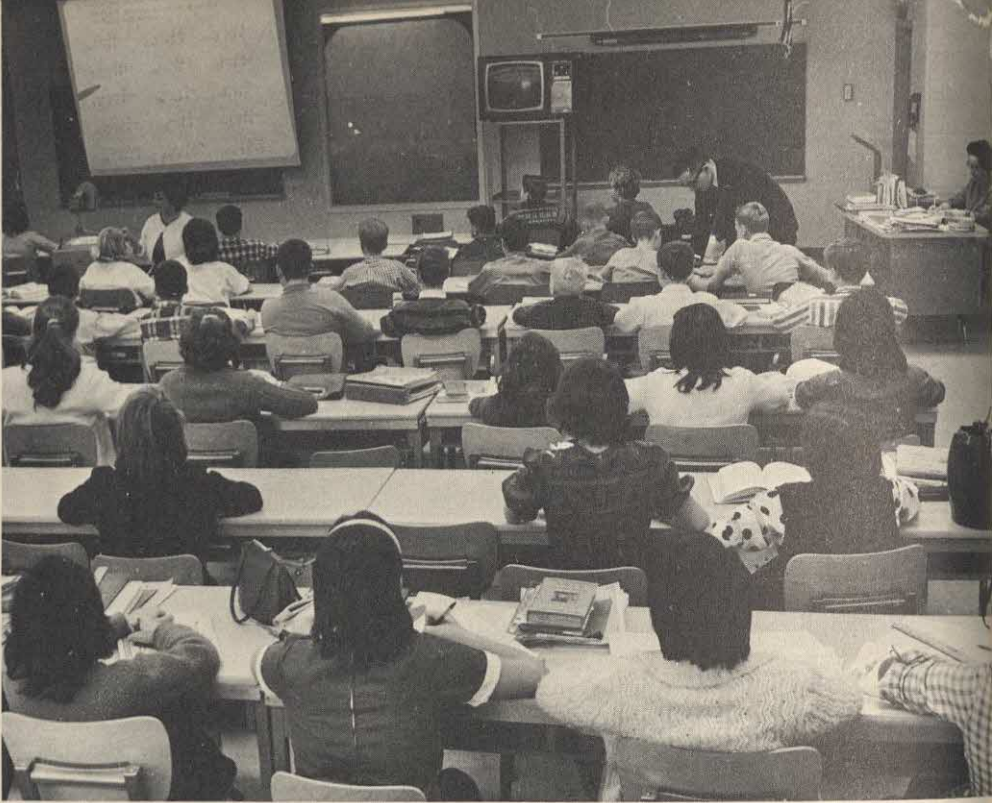


Figure 4-17. *Total Group Instruction Using the Overhead Projector.* (Courtesy Board of Education, Norwalk, Conn. Photograph by David H. Curl, The University of Connecticut, Storrs, Conn.)

1. In this setting the cooperating teacher is presenting visualized instruction in arithmetic. The team leader is observing the work of pupils, and the teacher aide at the right is performing clerical duties. Would this situation be likely to utilize unique abilities of teachers in the team?
2. Note the fact that the teacher at the overhead projector is seated. Line-of-sight vision to the bottom of an image on the screen is necessary or the view will be blocked.
3. Are assignment sheets and textbook references being used? Is there evidence that pupils are being asked to respond to directions of the teacher?
4. Is everyone being asked to do the same thing at the same time? Is this likely to be a characteristic of the kind of presentation shown?
5. A science presentation in this room for these pupils would undoubtedly call for diagrams and multiple overlays in color, with notes being taken by pupils. Problem situations could be introduced and noted for creative productivity by individuals and/or smaller groups during subsequent work periods.
6. Would the use of motion pictures, television, filmstrips, slides, and other media, be usable in large groups (or larger) than the group shown? *Note the rear-projection screen for motion pictures that are projected from the teachers' workroom behind it.*



Figure 4-18. *A Segment of the Total Group Engaging in Planned Activities.* (Courtesy Board of Education, Norwalk, Conn.)

7. What planning is necessary by teachers?
8. How would the basic principles of selection, readiness, control of arrangements, action, and evaluation be applied to large-group use of such instructional media as are shown in this panel?
9. What valid pupil performance (ability) is obviously being developed in this picture? In this case what information is being presented? What appreciations should be kept in mind by the teachers?
10. What functional practice should be carried out? Related to practical problems? Related to other subjects? What reading reference work?

SUGGESTIONS FOR OBSERVING FIGURE 4-18

This section of a "total group" has been scheduled for planned activities that either follow a session, such as depicted in Figure 4-17, or precede it. Do you recognize the teacher's aide from Figure 4-17. She is now in charge of the tape-playing operation and has probably checked volume levels or has just started to play the taped lesson:

1. Note the tape-listening operation in a booth-type installation for one group of pupils, while, simultaneously, the rest of the group is working on a textbook exercise. Can such a program of split activity be used for remedial work? For extra instruction for the gifted? Study period? Creative construction? Map work?

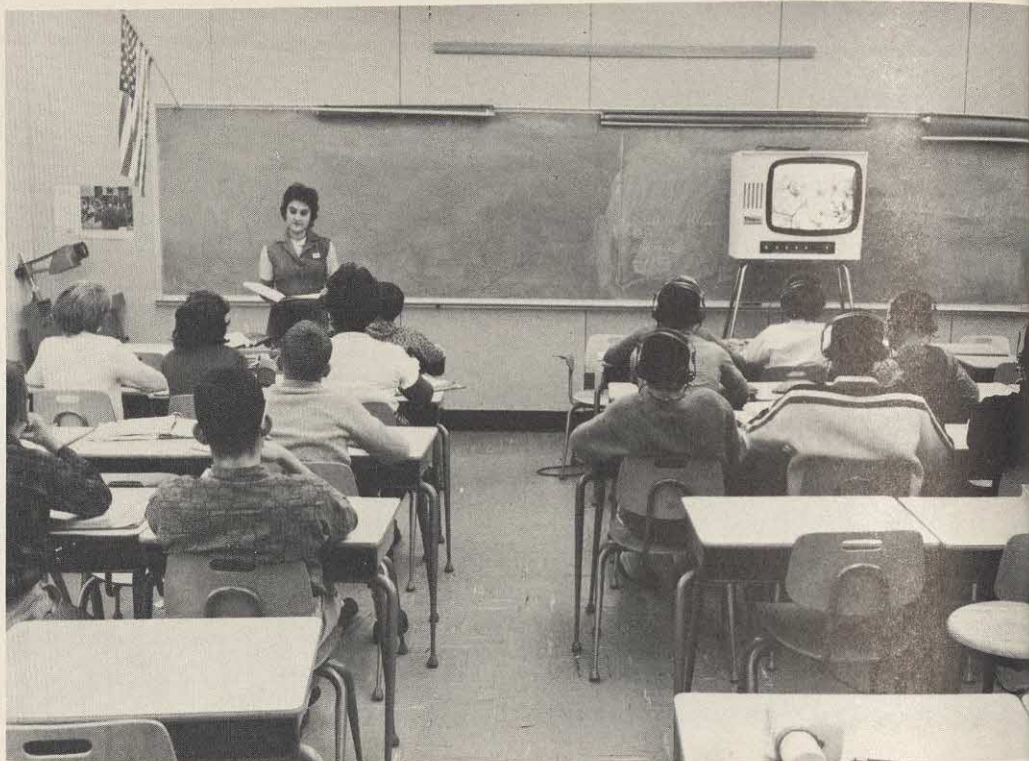


Figure 4-19. *A Segment of a Total Group Being Instructed by both Television and Teacher. (Courtesy Board of Education, Norwalk, Conn.)*

2. Note the typewriter on the desk. Does this suggest emphasis on preparation of unique teaching materials? Does it also suggest duties for the teacher's aide?
3. Does emphasis seem to be placed on pupil activity? Where does teacher activity show up in this panel?
4. Could the taped lesson be a short lecture? An explanation of a process? A presentation of a problem for a special assignment? Could a rotation plan be worked out for exchange of a number of activities, so that all pupils would take turns at different activities on a planned schedule?
5. Where does library work fit into this scheduling process? During after-school hours? During specified study hours? Voluntary homework?

SUGGESTIONS FOR OBSERVING FIGURE 4-19

A small-group section of a team is here shown being involved in two vastly different activities without interference. A scheduled television program from a nearby station or from the school-system closed-circuit installation is used instructionally for one group while a group of classmates has a face-to-face presentation by the teacher. Note headphone system for the television sound.



Figure 4-20. *Simple Facilities for Taped Instruction as an Integral Part of the Team-teaching Process. (Courtesy Board of Education, Norwalk, Conn.)*

SUGGESTIONS FOR OBSERVING FIGURE 4-20

This illustration shows a language arts session for hard-working pupils. Note plug-in jacks for headphones. Also note the overhead projector obviously assigned to that classroom and answer the following questions:

1. What precautions should be taken for tape-player failure? Spare tape player nearby for specified emergency purposes for a specified cluster of rooms? Spare sets of headphones needed?
2. How should students' work be checked? By teacher's aide? By on-the-spot observation, noting only those in need of remedial work?
3. How to provide for fast learners? Library work? Helping teachers help other pupils? Voluntary work on special problems as individuals or in groups.

SUGGESTIONS FOR OBSERVING FIGURE 4-21

This teaching team is making good plans, a crucial aspect of team success:

1. In the team-teaching operation specific decisions must be formulated by the group. Identify objectives? Plan activities for total group? For small group sections? Who is to do *what* and *when*?



Figure 4-21. Team Planning. (Courtesy Board of Education, Norwalk, Conn.)

2. What instructional media need to be used? Film? Television? Textbooks? In what combinations? What materials are already available in the school system and school-building service centers? What materials need to be prepared and by whom, and by what date? Slides? Tapes? Transparencies? Work sheets?
3. Where do curriculum guides, resource units, programed sequences fit into team teaching?

ANALYSIS OF CASE STUDY NUMBER 8

This case study presented an array of picture panels and a group of quotations by teachers, all showing or implying the action of a number of teachers working in teams. The reader is now directed to an ordered sequence of questions and observations relative to the instructional technology in this situation.

Ordered Sequence of Responses

1. Why do teachers of large groups believe that audiovisual media are important in making presentations? Hold attention? Provide easy to understand standard explanations? Make drawings and reading matter visible through enlargement?
2. Why not simply present a forty-minute lecture to pupils?
3. Do teachers that handle both large and small groups seem to need specially prepared transparencies, tapes, and slides for their own situations?
4. Do teachers in these situations count heavily on introductory, explanatory, and response sheets as a part of their teaching method?
5. How are the total-group sections ordinarily supervised?

6. Specifically what presentations in your field can be made to large groups without loss of instructional effect? Directions for a specific required action? Present introductory material by film, television, and filmstrip? Give assignments and explanations? Present programed learning sequences in steps requiring an immediate response?
7. What kinds of operations need to be carried out in small groups?
8. What kind of teacher preparation is needed for multi-group activity within one class?
9. How much of the total diet of pupil *activity* can be of the work sheet, blank-filling, and small-step variety? When should effort be expended on creative production and research by pupils? Do objectives determine this? Can teachers fall into the trap of "teaching the book" in team teaching perhaps more easily than in conventional teaching processes? If so, need this be the case?

Case Study Number 9

This final case study shows the medium of television in use in two widely separated school systems, namely, Anaheim, California, and Dade County, Miami, Florida. While it has already been pointed out that television may be put to work at a number of different levels, we wish to show its use in schools where its full potentiality for reaching both conventionally organized classroom groups and large, reorganized groups with superior teaching is being utilized. Furthermore, we wish to show the nature of the instruction employed where the television teaching is planned and originated within the school system itself. Therefore in this case we turn to the published guidebooks and telelesson teaching outlines supplied by the television directors of two school systems.³¹

For the purposes of this observation, excerpts and explanations will, for the large part, be confined to one telelesson in each school system, to show the kinds of teaching processes being carried on by both the studio television teacher and the classroom television teacher, and to reveal some of the many ways that technological media, including television, are being applied. In Anaheim, the subject is science, and the pupils are third-graders in a conventional class group. In Dade County the subject is American history, and the learners are in the eleventh grade in large groups of 320 or more meeting in auditoriums or cafeterias.

³¹ James D. Brier of Anaheim City Schools, California, and Clif Mitchell of the Dade County Board of Public Instruction, Miami, Florida.

PART I—DIRECT TEACHING BY TELEVISION: ANAHEIM

The Actual Situation

The situation ³² in the Anaheim aspect of this case study simply stated is that approximately thirty-two third-grade science pupils in the Anaheim City Schools, Anaheim, California, are being taught not only by their regular teacher in a conventional self-contained classroom every day of the school week, but in addition by a television teacher two days a week on schedule. Their regular face-to-face teacher watches the telelesson with the students, but she has also prepared her pupils for the program and has had the benefit of an instructional TV Guide and also specific teaching outlines from which quotations will be excerpted a little later. Actually, this third-grade science class in our case study receives direct instruction by television according to the following schedule: ³³

Social Studies: Monday, Wednesday, Friday at 10:45 A.M.

Science: Tuesday and Thursday at 10:45 A.M.

Music: Monday at 1:20 P.M.

Arithmetic: Wednesday at 1:20 P.M.

Now let us turn to the use of technology, to the teaching acts of the television studio teacher and of the classroom teacher and to the activities of pupils as they make contact with a segment of Unit VII, *Simple Machines*, of the major topic, *Matter and Energy*. The segment is *Lesson 50*, for April 23, 1963, entitled *Wheels*.³⁴

Objectives in Elementary Science

In addition to concepts relative to simple machines, wheels in particular, and their operations, the following objectives identified as skills are clearly set forth in the TV guide prepared for teachers:

Science also provides many opportunities for developing the language art skills of reading, writing, speaking, listening, and research. In addition, these science skills should be developed: formulation of scientific principles and generalizations, accurate observations, problem solving ability, and the skills of scientific thinking.³⁵

With these objectives in mind we turn to the teaching outline ³⁶ to find out

³² The Anaheim Plan, Anaheim City School District, Anaheim, California; Robert E. Shanks, Superintendent of Schools, James D. Brier, Instructional Television Director.

³³ Anaheim City School District, Instructional Television Project, *TV Schedule—1962-63*, Grade 3.

³⁴ *Lesson 50, Wheels*, Tuesday, April 23, Science Grade 3, Instructional Television, Anaheim City School District, Anaheim, California, Mimeographed, 1963.

³⁵ *Instructional TV Guide*, Anaheim City School District, Anaheim, California, Mimeographed, p. 28.

³⁶ *Lesson 50, Wheels*, Tuesday, April 23, Science Grade 3, Anaheim City School District, Anaheim, California, Mimeographed, 1963.

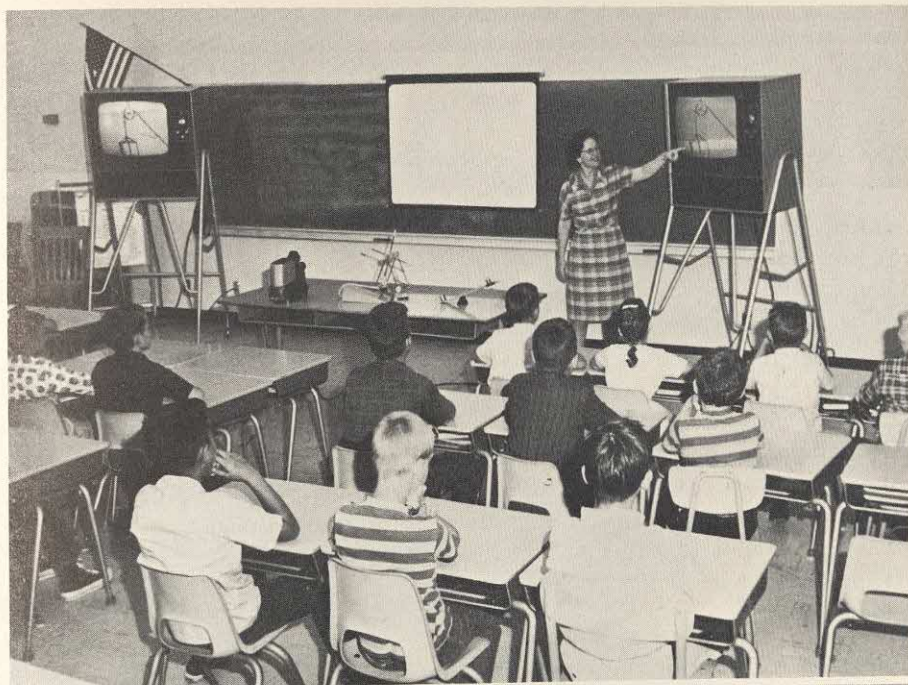


Figure 4-22. This third-grade science teacher is following the teleleson closely, and is pointing for emphasis as the pupils watch. Other media are in evidence as resources. By being well acquainted with this program, this teacher is quick to demonstrate, using some available equipment along with a telecast diagram.. (Courtesy Anaheim City School District, Anaheim, Calif.)

what the classroom teacher was asked to do to prepare the class for the telelesson.

Classroom Teacher Activity Prior to Telelesson

According to suggestions in the special guide sheets, the teacher conducts a discussion with her pupils centered on specific questions listed in the teacher outline as follows:

What makes a bicycle move? On what part does it move? What makes these parts move? Use a real bicycle in the classroom to answer these questions.³⁷

In addition the teacher distributes some special work sheets for use during the telelesson, and the necessary textbooks are on the pupils' desks. The television set is turned on and tuned just before starting the discussion. The studio clock appears on the screen of the receiver to help the teacher time her discussion and class preparation activities properly. At precisely 10:45 A.M. as scheduled the telelesson teacher at the studio greets the class and assumes control.

The Studio Telelesson Teacher in Action

The studio teacher then uses models, apparatus, and motion picture clips to make a well-prepared, well-timed, appealing, motivating, and challenging presentation that demonstrates the following understandings as presented in the teacher outline for Lesson 50:

Wheels make work easier.

Wheels help us work faster.

Wheels work together to make work easier and/or faster.³⁸

The studio teacher stimulates the young students to carry on additional activities and refers to the textbooks the pupils have on their desks. In fact she suggests some specific problems for the regular classroom teacher in her presentation and has already presented such additional activities to the classroom teacher three weeks previous in the teacher outline which in the Anaheim plan is prepared by the studio teacher as one of her basic responsibilities.

Classroom Teacher Activity Following the Telelesson

Immediately following the telelesson, the regular teacher organizes activity on the special problems just suggested. The students proceed to experiment, observe, and draw conclusions, study their textbook and other classroom library references, and view a filmstrip entitled *How Wheels Help Us* as they engage in the following learning experiences. Such activities are referred to as related classroom instruction and are listed in the teaching outline for Lesson 50 as follows:

³⁷ *Ibid.*, p. 1.

³⁸ *Ibid.*, p. 1.

Figure 4-23. After the telelesson the classroom teachers are assisted by detailed suggestions to promote significant learning activities. In these pictures the teacher is providing additional information by means of a filmstrip. Other classroom activities such as textbook study and pupil demonstrations as shown indicate that the formal viewing of instructional television is not a passive process for youngsters in Anaheim. (Courtesy Anaheim City Schools, Anaheim, Calif.)



If possible, use a wagon to show how wheels are useful. Then remove the wheels and try to move the wagon. How would the wagon be of greater value, with wheels or without wheels?

Have a hand egg beater in class. Let the children examine it. How many wheels does it have. Are these wheels different from the wagon wheels? How? What happens when the handle of the egg beater is turned? Have the students observe very carefully and closely as the beater is turned. Do all of the wheels turn at the same rate of speed? Which turns faster, the little wheel or the handle? How is the egg beater used to help us in our work?

Explain to the children that wheels with teeth on them are gears. Find gears on a bicycle. What other machines have gears? Examine pictures from magazines and point out wheels and gears.

Make a very simple model of the wheel and axle or windlass. Use a long handled broom over the backs of two chairs. Wrap cord around the middle of the broom handle. A weight can be tied to the cord and lifted up as the broom is turned. (The handle of the broom acts as the axle and the brush of the broom would act as the wheel.)

Lead the students to discover that the pencil sharpener and the door knob in the classroom are other illustrations of the wheel and axle.

Have a bicycle in the classroom. The pedals act as the spokes of the wheel. Examine the gear wheels and the chain used to drive the wheels.³⁹

While teachers are encouraged to utilize a wide range of reading materials, the teaching outlines submitted in advance include specific references suggested by the studio teachers. The following were listed for the telelesson in this case study.⁴⁰

Science Far and Near, pp. 250-255

How and Why Wonder Book of Machines: Let's See Why, pp. 117-121

How Do We Know, pp. 74-85

Science Is Exploring, pp. 134-135

ANALYSIS OF CASE STUDY NUMBER 9:

PART I-ANAHEIM

We now need to examine the basic aspects of the application of television technology and to direct the observation of the reader to the teacher's plans and processes. In scrutinizing this case the reader needs to bear in mind the concepts set forth in Chapter 3 as well as the operational features identified in Chapter 5.

Ordered Sequence of Responses

1. Is the television presentation (the telelesson) a carefully integrated complex of audiovisual cues, that is, language, models, apparatus, charts, film clips, slides? Are new concepts thus presented to many groups throughout the school district? Directions given for attacking and working on problems?
2. Do regular classroom teachers in this situation carry on the design created by the studio teacher? (Check the classroom teacher's respon-

³⁹ *Ibid.*, pp. 1-2.

⁴⁰ *Ibid.*, p. 2.

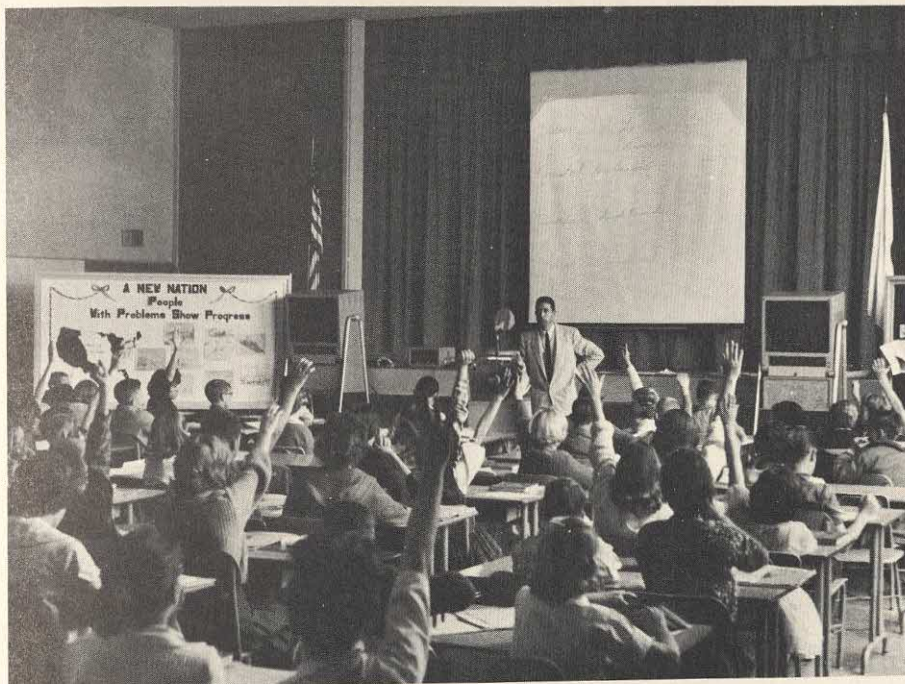


Figure 4-24. In grade 5 the Anaheim plan for instructional television calls for the use of television for large groups. Such learning spaces are called resource classrooms. They are well equipped to provide opportunities for the use of other media during sessions following the scheduled telelesson. Such a resource classroom is shown in this illustration with teacher activity in progress. (Courtesy Anaheim City Schools, Anaheim, Calif.)

sibilities at Anaheim by turning to the quotation under *Television* in Chapter 5.)

3. Is the television program or telelesson then treated by the regular classroom teacher as a unique instructional medium, as for example a special kind of motion picture?
4. What is the basis of planning for the telelesson content? Teaching objectives? Name some of them: Abilities? Understandings?
5. Do the follow-up activities suggested by the *studio* teacher and organized and carried on by the *classroom* teacher appear to contribute to the valid objectives stated? Explain, using a specific example.
6. How did the classroom teacher apply the readiness principle in preparing for the telelesson? List the elements in the readiness plan.
7. Is problem-solving a characteristic of the related classroom instruction? Where does textbook reading fit into this activity? Where could additional films and filmstrips fit?
8. Is control of physical arrangements by the classroom teacher important?

9. What would you do as a classroom teacher if the television receiver failed just as the telelesson was about to start?
10. Supposing there were no plans for related instructional activity following the telelesson. What then would be the nature of the telelesson plans? How would they have to differ from the described format for Anaheim? Provide for student responses on worksheets during the telelesson? Assume complete control of assignments perhaps at home? Call in written work for grading by trained assistants?

PART II—DIRECT TEACHING BY TELEVISION: DADE COUNTY

In the Anaheim aspect of this case study the studio teacher taught a third-grade science telelesson to a large number of classroom groups of conventional size, and the classroom teacher played an important role in preparing the students and in following the telelesson with planned instructional activities. In the Dade County⁴¹ aspect of this case, based on mimeographed reports and teaching outlines, we show a situation where a group of some 320 high school juniors receive instruction by television in American history, in the high school auditorium daily from 1:20 to 1:47.

The Actual Situation

The situation as reported here refers to Lesson #83, on *Political Theories (1800–1828)* described in the ETV Teacher's Guide.⁴² In the class of some 320, a team of two teachers and a teacher's aide takes charge. In this instance, the history teacher takes charge of the group and conducts follow-up teaching activity for history telelessons and is assisted by the English teacher on the team. Preceding the history telelesson is the English telelesson from 11:50 to 12:17 and during this daily telecast the English teacher takes charge and is assisted by the history teacher. The teacher's aide takes attendance, sets up equipment, and assists with other clerical work. There is one 23-inch table model television receiver for each group of 50 pupils and all the sets are turned on with a master switch. A studio clock is shown on the receivers, so the classroom teacher can time his preparatory comments at the opening of the class.

The telelesson lasts for twenty-seven minutes, after which other teaching activities, suggested in the Guide, are carried out with all of the students participating in some way in the assignments.

Purposes and Content of the Telelesson

According to the guide⁴³ for Lesson #83 the purpose was, "To show the

⁴¹ *Dade County ETV (1962–63)*, Dade County Board of Public Instruction, Miami, Florida, Mimeographed. Joseph Hall, Superintendent of Schools, Clif Mitchell, Director of Television Education.

⁴² *American History, 11th Grade, ETV Teacher's Guide, Second Semester, 1962–63*. Dade County Board of Public Instruction, Miami, Florida.

⁴³ *Ibid.*, first page of the lesson outline.

changes occurring in the Republican Party," and the content presented by the studio teacher over WSEC-TV, Channel 17, was as follows:

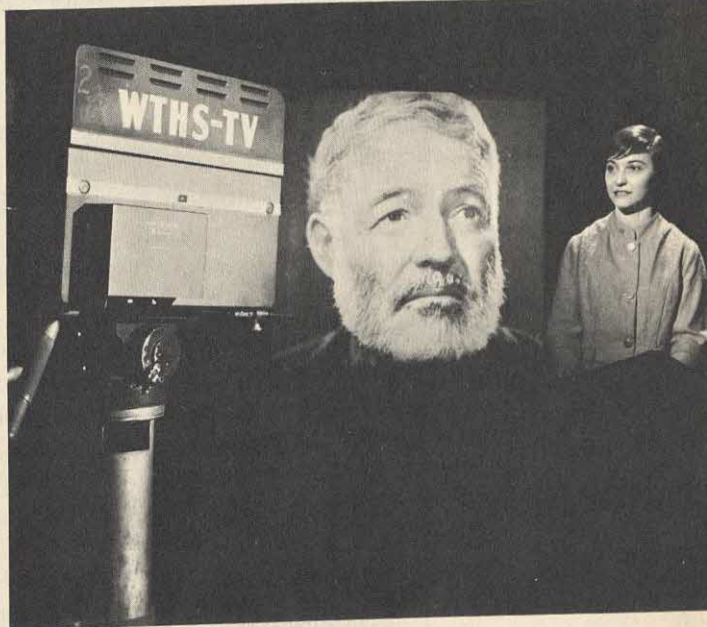
- I. Revolution of 1800
 - A. Jeffersonian Republicanism
 - B. Decline and Fall of the Federalists
- II. One Party Government (1816–1824)
 - A. Republican unity
 - B. Split in Republican Party
- III. National Republicans
 - A. Leaders
 - B. Platform
- IV. Democratic Republicans
 - A. Leaders
 - B. Platform

Studio teachers devote full time to their presentations and they make wide use of charts, slides, film clips, and other pictorial and graphic illustrations for effective communication.

Learner Activity in Large Groups

The studio teacher and classroom teachers work together in workshops to improve teaching processes, and they devote a great deal of attention to the planning of learner activity in the classroom portions of the lessons. In this instance, Lesson #83 on *Political Theories (1800–1828)* calls for background readings in the textbooks of twenty-seven pages and participation in one or more of the activities, suggested in the teaching outline as follows:

Figure 4-25. This studio teacher in the Dade County Instructional Television program has a wide range of media at her command. Such resources are an essential element in the success of television teaching. Studio teachers work closely with classroom teachers. Together they plan optimum arrangements for pupil participation in learning activities. (Courtesy Dade County Board of Public Instruction, WTHS-TV, Miami, Fla.)



Suggested Classroom Activities

1. Have students prepare transparencies cartooning the issues of 1800–1828.
2. Prepare a two-column display. In one column put Jefferson's stand on controversial issues. Students list compromises he had to make in Column two.
3. Show film "Thomas Jefferson" EBF 20 min. Students preview, summarize.
4. Map work: Louisiana Purchase. Construct a map of the area, identifying key cities, capitals, products (dollar volume), population; compare to nation.
5. Assign student reports on Napoleon and how his rise to power affected our history.
6. Depict Louisiana Purchase by symbols such as "Breadbasket of the United States."⁴⁴

The classroom activities and assignments are an integral part of the television teaching process and the classroom teacher follows up the studio teacher's stimulating presentation by making arrangements with students for participating in the assignments. Student notebook and project work are checked periodically. Under ETV conditions teachers of large groups have but three teaching periods daily, two large and one regular-size class.

ANALYSIS OF CASE STUDY NUMBER 9: PART II—DADE COUNTY

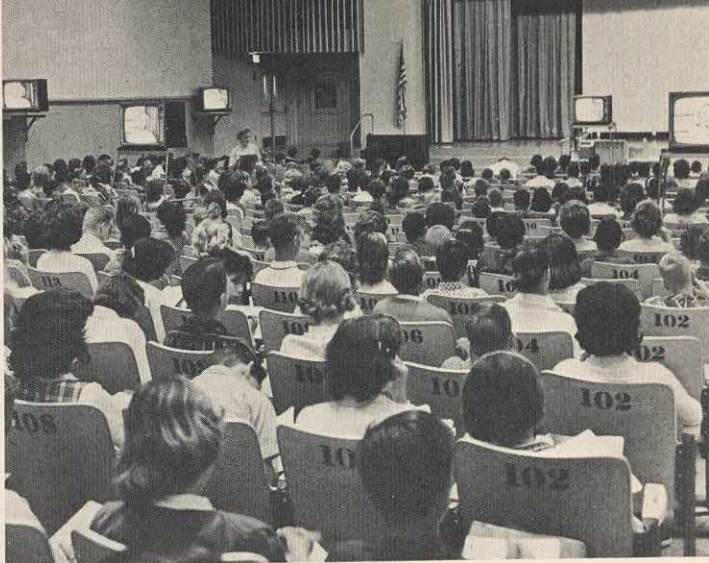
We now review the situation just presented and ask the reader to scrutinize the process and perceive some crucial relationships.

Ordered Sequence of Responses

1. Note that the follow-up activities for the telelesson were for one day only. Additional activities were prescribed every day. If the film were ready for projection at the conclusion of the telelesson only seven minutes would remain for a student summary. Note that a group of students would have previewed the film and prepared pertinent summary statements.
2. What planning and checking on the part of large-group television teachers would it require to make sure that one or more activities were accepted by pupils and completed on schedule? How could the teacher's aide help with this work? How to get optimum balance for each pupil? How many of the activities listed do you believe an eleventh grader could complete in a 54-minute study period?

⁴⁴ *Ibid.*, second page of the lesson outline.

Figure 4-26. Note the placement of television receivers for this group of some 320 students. Note also evidence of other media. The screen on the auditorium stage is used for presentations following the telelessons. A motion picture projector and an overhead projector are at the front of the room. (Courtesy Dade County Board of Public Instruction, WTHS-TV, Miami, Fla.)



3. Assuming that each day a stimulating visualized presentation were made by the studio teacher about crucial content in eleventh-grade history, would additional activities beyond note taking be necessary? What abilities, attitudes, and appreciations, in addition to understandings, should students develop in a history course? What homework and library work become necessary to achieve these objectives?
4. If the large-group teacher uses a microphone would not two students in a role-playing situation need to use them also?
5. Would not a discussion in a group of 320 pupils be a waste of time? Could you get participants to "talk up"?
6. What student-work exhibit areas are needed for the display of art work, posters, and so on?
7. Could notebook work or completed work sheets based on the studio teacher's presentation and textbook reading be easily checked by the classroom teachers?
8. Can students get lost and lose interest with too many miscellaneous activities to complete? What is the relationship between proper pacing and the established teaching objectives?

Problem-Solving Activities

1. Name the two most responsible and professional acts of a competent teacher. Explain as succinctly as you can the relationship of these two separate activities.
2. Explain why it is possible for a teacher to "pull the wool" over an observer's eyes if he has students working on interesting activities?
3. Having valid teaching purposes in mind is valuable to the teacher as

- a means of thinking, planning, and guidance for decisions. Explain these benefits by using specific examples.
4. Study the sample statements of teachers' purposes in this chapter and work through the sequence of questions following each set, regardless of your subject-matter field, digging as deeply as you can into the analysis.
 5. Using the criteria in this chapter for stating them, write out a set of valid teaching purposes, one each of the kinds described, that you will be using in the future as a basis for teaching. Emphasize critical appraisal of each item. Hand in your set for evaluation. Compare your statements with those of your colleagues and if feasible and desirable, help your instructor evaluate the papers of your classmates. If you do not do well the first time, hand in another set for a better record.
 6. Examine yearbooks and other reference books relative to general education as well as to your specific teaching field, and then state several of the key concepts, abilities, attitudes, and appreciations that teachers in your field should bear in mind continually.
 7. Study with painstaking effort each of the nine case studies in this chapter. Work through without fail each set of ordered questions and judgments to penetrate deeply into fundamental teaching activities and to comprehend the need for creative decisions. Be sure to examine each of the films used, as a basis for the case studies. Save time by looking at these films during one class period or in a large-group preview session.
 8. Create a plan for using a motion picture of your own choice for any future or present group you name, being guided by the five basic principles set forth in the last chapter. Base this plan on a good set of teaching purposes and a good main problem. Use what power you have gained from exercises in Chapter 4, and from Exercises 1 through 7 in this study guide. Use the outline revealed in Case Study Number 1 and Case Study Number 2, that is, following each major item as described by A through H, write out the prescribed headings, and write out your decisions under those headings.
 9. As a separate exercise revise the plan just completed in Exercise No. 8, preceding, making it conform in design to Case Study Number 4. The specific difference is that in Case Study Number 4 the main problem or group of problems arise after the film showing, not before it. This condition calls for changes in planning. Make those changes in writing, and be ready to justify them.
 10. Again scrutinize Case Study Number 6 dealing with self-instruction techniques. Also read near the end of Chapter 2 the description of the *Instructional Kit* medium. Does the so-called *Learn by Yourself Kit* appear to be an *Instructional Package*? What was the role of the teacher?
 11. Following the outline of decisions as set up for Case Study Number 1 and Number 2, prepare in a terse form a written plan for using a filmstrip of your choice for any future class you name. Be sure to state valid teaching purposes in sufficient number and breadth to provide a basis for sound thinking.

12. Explain in a statement of four or five sentences how the five guiding principles stated in Chapter 3 may be applied in general to the use of an instructional tape.
13. Scrutinize Case Study Number 9 dealing with the use of a television program and identify the source of teacher purposes and the source of follow-up activities. Explain as accurately as you can the roles played by the studio teacher and the classroom teacher, either in large or small groups of learners.
14. Work with two other classmates in your teaching field to create a team-teaching plan for achieving an identified instructional objective. Arrange to present the lesson to the class, or write it out and report the major elements in a short class presentation.
15. Identifying any valid instructional objective of your choice, state a pupil problem (pupil purpose or assignment or activity) and then report in your own words in summary form, extemporaneously, the kind of design you would create to achieve the objective. State the specific nature of the technological media you would use.

Available Technological Materials for Class Use

And No Bells Ring. 16mm motion picture. NEA (Department of SS Principals). B & W. 57 min. (in two parts). (Use to study new patterns of teaching and learning. Emphasize the application of case studies in this chapter to those operations.)

Unique Contribution. 16mm motion picture. Encyclopaedia Britannica Films. Color. 30 min. (Use as a basis for formulating unique potential purposes for film excerpts shown and possible teacher plans for readiness and action.)

The Following Motion Pictures Are the Films Used in the Case Studies Reported in This Chapter:

Volleyball Techniques for Girls, Revised. 16mm motion picture. McGraw-Hill. B & W. 10 min. (Use as a basis for evaluating statement of teaching purposes, *Sample 2* in this chapter.)

Baby Animals. 16mm motion picture. McGraw-Hill. B & W. 10 min. (Use as a basis for evaluating teaching purposes in this chapter, *Sample 3*.)

Boring and Drilling Tools. 16mm motion picture. McGraw-Hill. B & W. 10 min. (Use as a basis for evaluating teaching purposes, and for checking the teacher decisions in *Case Study Number 1*.)

Panama Canal. 16mm motion picture. Coronet. B & W. 10 min. (Use as a basis for evaluating the teacher decisions in *Case Study Number 2*, and in *Case Study Number 4*.)

The Mathematician and the River. 16mm motion picture. Educational Testing Service. Color. 10 min. (Use as a basis for evaluating teacher decisions in *Case Study Number 3*.)

Pioneers of the Plains. 16mm motion picture. Encyclopaedia Britannica Films. B & W. 10 min. (Use as a basis for evaluating teacher decisions in *Case Study Number 5*, and for evaluating purposes in *Sample 1*.)

Thomas Jefferson. 16mm motion picture. Encyclopaedia Britannica Films. B & W. 20 min. (Use to provide first-hand knowledge of one of the follow-up activities for teleleson #83 for American History, Grade 11, Dade County, Miami, Florida.)

Some Additional References

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5

SPECIFIC TEACHING PRACTICES CHARACTERISTIC OF VARIOUS MEDIA

In the preceding pages, especially in Chapter 3, five basic principles were presented and discussed as an overall system for guiding teacher decisions relative to the selection and use of audiovisual materials. It has been repeatedly emphasized that this system of principles applies to all technological materials; however, teachers also need to consider some of the unique characteristics of the media they wish to put to work. Therefore, some specific suggestions about teaching practices are given in this chapter for various media. The suggestions given are intended to facilitate the application of the basic utilization principles and to explain, in addition, some of the instruments and processes that do not come under the principles at all, such as electric pointers, and to emphasize that several technological materials often need to be used in combination. First, we turn to the operational aspects characteristic of field trips.

FIELD TRIPS

It was pointed out in Chapter 2 that field trips provided the most realistic means for the study of real things and processes in their actual environments. But there is no doubt that whenever a class of pupils is taken out into a more or less unfamiliar environment, extra planning of activity must take place, and this planning may have dire consequences unless it is expertly done.

Basic to the success of any field trip is the valid reason for taking the trip; teachers would do well first to examine their own valid teaching purposes and then the pupil purpose (the problem or job to be done) that has been set up, the solution for which the trip is being taken. Having a strong problem base for all field-trip operations constitutes the vital factor for success. This is because the problem to be solved then calls for certain kinds of advance planning, determines the kinds of activities pupils should carry on during the trip, and then provides the basis for activity after the trip is over. Those teachers who are foolish enough to herd pupils on buses or trains and start off on a *lark* are advised to carry an extra supply of aspirin and tranquilizers. A field trip that is based on a good problem to be solved and is expertly organized and arranged is very likely to be an extremely rewarding experience for both teacher and pupil.

Operationally, then, field trips present special features that have to do with the rearrangement of class time schedules, arrangements for transportation, the organization of pupils and their basic observational tasks, and the procurement of official approval for taking the trip.

Specific Teaching Practices. Suggestions for the field trip process are as follows:

1. Set up a vital problem, either constructional or investigative in nature,

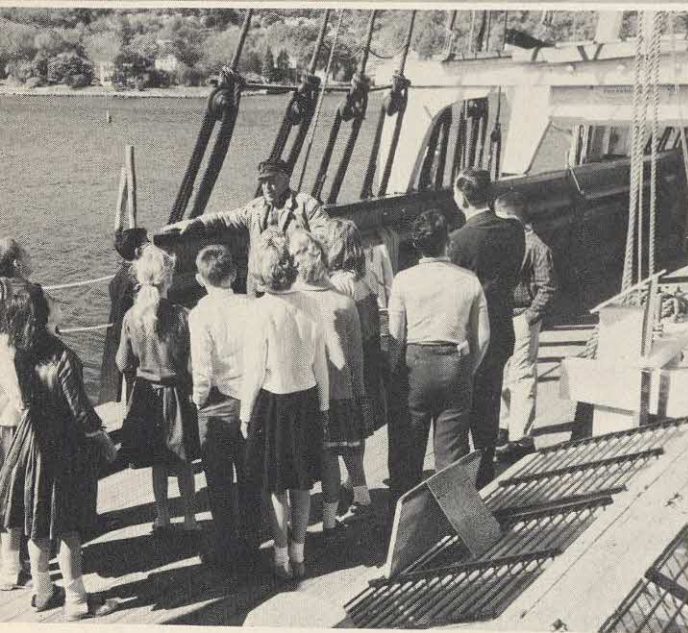


Figure 5-1. The teacher of this school group has definite professional responsibilities. Decisions need to be made regarding the objectives, and a main problem, the real reason for taking the trip, should be established, recognized, and accepted by the class. Planning needs to be done as to what information should be or needs to be gathered, what questions need to be asked, who should ask them, what details need to be worked out as to clothes, money, and travel schedules. In addition, in some cases, agreement needs to be made as to the standards of conduct that will be observed on the trip. These are the ingredients for a successful field trip. The class group shown is fascinated as they see the *Charles W. Morgan* whaling vessel at Mystic Seaport, Mystic, Conn. Aboard the vessel they ask the guide, dressed as a seaman, questions about the ship, its history, and its importance in relation to the Mystic Seaport village in the days of the whale oil lamp. Can you state a good teaching problem that would meet the criteria stated in Exercise No. 17 at the end of Chapter 3? (Courtesy Mystic Seaport, Mystic, Conn. Photograph by Louis S. Martel.)

and then plan the trip as the means of seeking and obtaining information for solving the problem. That is, analyze the problem and guide students in getting the facts needed by actual on-the-spot observation. Use cooperative planning techniques.

2. Organize and conduct field trips only when they provide rich experiences that lead to building specific concepts, insights, and abilities.
3. Seek public transportation, or, if private cars have to be used, ascertain that drivers have procured adequate insurance for the trip's duration. Make other needed arrangements as to time schedule, food, financing, and clothing requirements.

- 232 4. Find out about local precedents for this kind of learning activity, and

find out who is responsible in case of accidents. In cases where permissive legislation does not already exist, obtain a written letter of authorization from the board of education.

5. Obtain parental consent slips as a means of good school-home relations. (Of course, with the realization that they are of little value in court.)

MODELS, OBJECTS, AND APPARATUS

Teachers need to judge as precisely as possible the amount and kind of direct experience with real things that is needed before abstractions presented in the rapid-fire fashion of most classrooms can be comprehended and retained. By saying this another way, we can state that the level of experience possessed by students needs to be assessed in order to communicate effectively. While models and apparatus may be far more effective in promoting understanding than words alone, teachers need to recognize and overcome certain pitfalls to learning that are inherent in their use.

Specific Teaching Practices. Operationally, specific teaching practices are as follows:

1. Teachers should make sure that misconceptions because of inconsistent scale, color, and shape are corrected.
2. Make arrangements so that materials may be clearly viewed, read, or interpreted. Use large labels when necessary.
3. Ask students to predict happenings or changes that are to take place to emphasize powers of student observation, inference, and response, and, of course, to heighten attention.
4. Arrange models and apparatus with suitable labels and work sheets with questions for student observation outside of class time. Additional assignments may be made that call for reports based on observation.
5. Bear in mind when demonstrating processes that pupils are facing the instructor and that right-left hand positions are accordingly reversed. Explain right-left hand actions if students are supposed to be following motions in their own minds.
6. Point out the difference between models and apparatus and the real thing by questions and explanations. Also when real objects are shown and observed, check accuracy of students' concepts relative to the real-life setting for the objects.
7. When planning to conduct demonstrations using models, objects, and apparatus, list items needed and write out the step-by-step procedure, anticipating difficulties in understanding likely to be

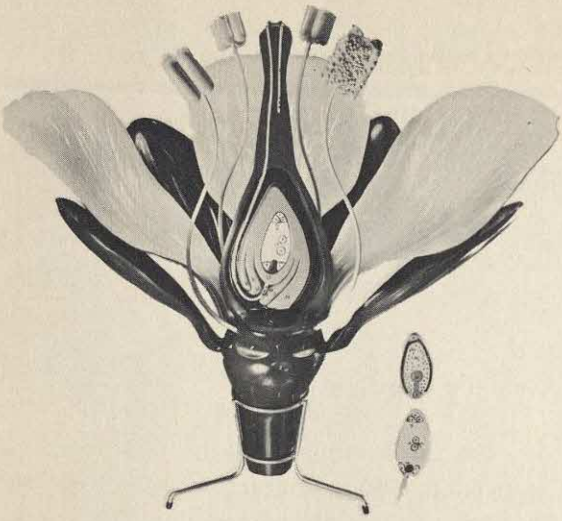


Figure 5-2. Models need to be studied, not just looked at in picturebook fashion. This calls for teacher guidance in making problem-oriented observations. Class assignments involving such models should, therefore, be structured for small group observation at close range. Details need to be "readable." (Courtesy A. J. Nystrom & Co., Chicago, Ill., first picture.) In the second picture a teacher of physics is using apparatus so that his students may view images of a sodium flame as seen through a diffraction grating. (Courtesy Edwin O. Smith School, University of Connecticut, Storrs, Conn. Photograph by the author.)



- encountered by students. Rehearse the experiment or demonstration whenever feasible before performance in front of the group.
8. Use chalkboards for demonstrations to outline main points for students. Also slides and charts to explain complicated processes and show close-up views.
 9. Whenever time permits, stimulate students to ask questions and draw conclusions on the spot.

CHARTS AND DIAGRAMS

One annoying problem that must be borne in mind continually when using charts and diagrams is that details and lettering may be too minute to be visible to students at their seats. Hence special teaching practices are required. Instructors must either point to and read the difficult-to-see lettering or arrange to have students view the chart in small groups. Another serious problem that requires special teacher action is the need to bridge the gap between the diagram and the reality it is supposed to

Figure 5-3. This picture on the process of adjusting jointer knives was made from a chart in the form of a 2-inch by 2-inch slide in color. The teacher made the paste-up from which the slide was made from colored construction paper cutouts, and instant-type labels. He based his work on a textbook illustration in black and white. Such charts may be made up on large-size posterboard and stored for repetitive use or may be made in 4-inch by 6-inch (or larger) size and photographed in color. (Courtesy C. B. Smith, teacher, and printed with permission from Edward W. Foss, Construction and Maintenance for Farms and Home, 1960, John Wiley & Sons, Inc., Publishers, New York, N.Y.)

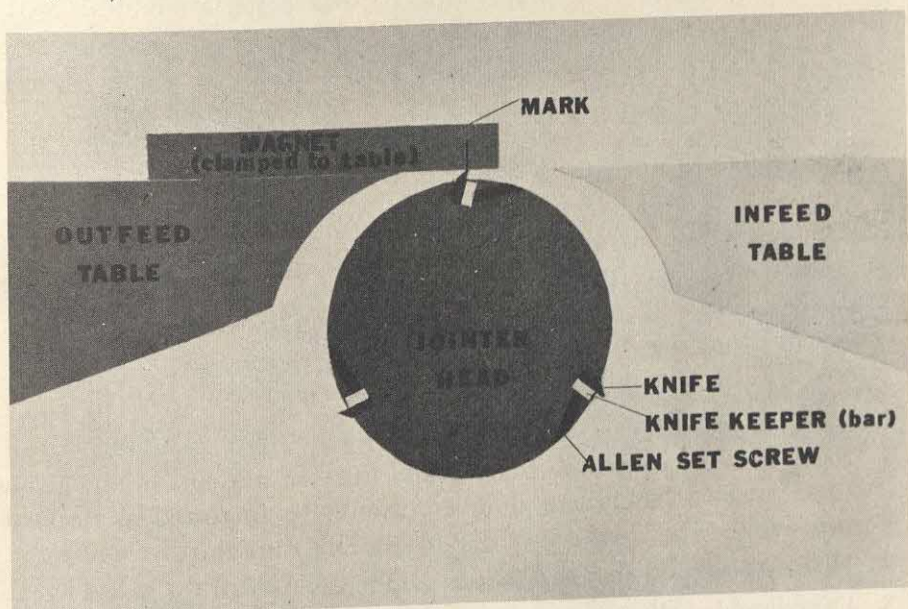
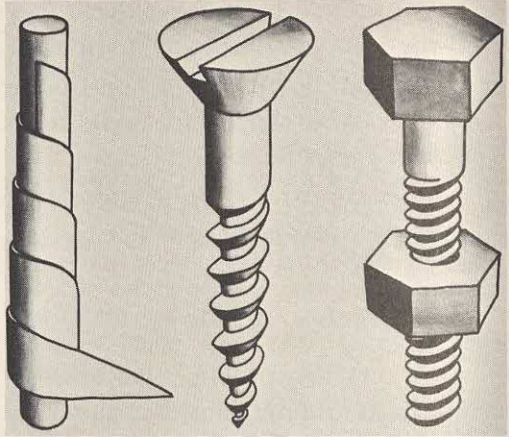


Figure 5-4. The significant details of this diagram of a screw as an inclined plane may be observed from a distance of 30 feet. It is 11 by 14 inches in size and is from a set of study prints entitled *Simple Machines*. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)



represent. Teachers need to question students about their experience levels and understanding, and ascertain whether misconceptions of the real thing or process exist, making corrections as needed.

Whenever charts and diagrams have to be prepared, instructors should remember that small illustrations in texts may be enlarged by projecting them with an opaque projector in darkened rooms. In carrying out this process, illustrations are projected onto white wrapping or posterboard paper taped in sections to chalkboards or walls. Tracing is then easy to do against the solid surface.

Teachers should also consider remaking their diagram and chart material into slide or transparency form for more effective use and easier storage and handling. The preparation of such materials is dealt with briefly in a later chapter.

CHALKBOARDS

A great many instructors constantly use chalkboards. Of course those instructors who have overhead projectors in their classrooms will not want to spend hours redrawing complicated diagrams every year, but the chalkboard is likely to be used so much that some suggestions are in order.

Specific Teaching Practices. The following specific operational techniques will help teachers make better use of chalkboards:

1. Write or make figures on the board and then walk back to the rear of the room to ascertain the viewing difficulties of students in any given room. Size of letters and numbers should be increased as deemed necessary. Check readability due to glare of sunlight or room light.
2. Use templates for standard figures frequently needed for board work.
3. Use colored chalk.

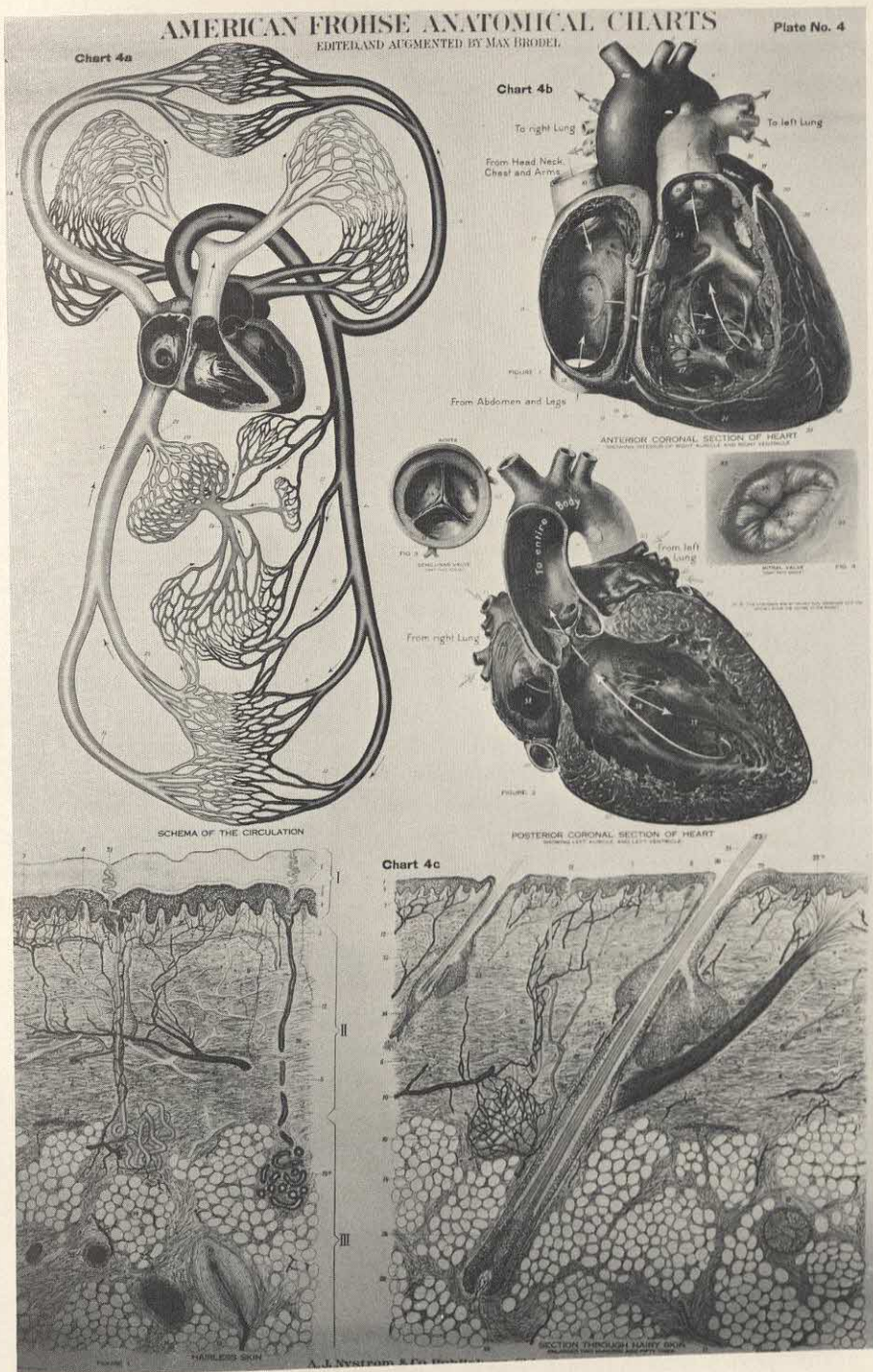


Figure 5-5. Despite the amazing clarity of detail in charts as in this American Frohse Anatomical Chart, in color by Professor Max Brodel, teachers should be sure to guide students in bridging the gap between diagram and the real object in its real setting. (Courtesy Central Scientific Company, Chicago, Ill.)

4. When beneficial, reveal drawings and outlines at the right time by uncovering sections of the board previously hidden by panels of wrapping paper, or by a cloth drape system if available.
5. Avoid blocking view of chalkboard content. Stand to one side. Use a pointer to focus attention.
6. Put diagrams or drawings on the chalkboard ahead of time with barely visible lines, and then fill them in boldly in front of the class during the presentation. (Instructors may waste too much valuable class time by making complicated drawings while class members idly watch. Transparencies and slides may be more economical of precious time for student-teacher contacts.)
7. Use the grid method for transferring enlarged drawings from small-size pictures to the chalkboard. (Cover the small picture with a grid of one-inch squares. Draw a system of larger squares on the chalkboard. Copy small drawing square by square.)

When presenting content by charts, diagrams, maps, or chalkboard drawings, a pointer will allow the instructor to focus attention for purposes of explanation. Teachers should heed a few hints. Use the pointer only when it is valuable, *then lay it down*. Do not hold it, tap it, point it at people, bend it, or touch the floor with it. Teachers who want maximum freedom to maneuver equipment or organize projected materials during a class presentation would do well to use a battery-operated electric pointer. Often an instructor may, then, remain at the rear of the room where some types of projection instruments are normally operated.

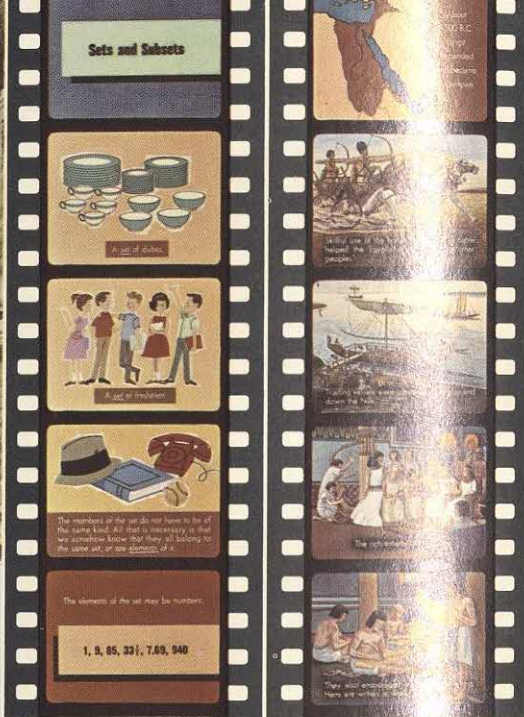
MOTION PICTURES

It has already been pointed out that the use of the *film clip* is a common procedure in television. The main point we shall make here is that there are a number of ways of running off a film in a classroom. A few of these possibilities are:

1. Running the film in segments, stopping for discussion and review, in cases of long technical films.
2. Running off the film introduction before the class group arrives, to the first pictorial frame, when titles and credits are either too long or inappropriate for the problems under consideration.
3. Projecting the film without the sound track, that is, as a silent film, thus permitting the teacher to make his own commentary and conduct terse questioning during projection.
4. Reshowing a film in the light of established needs and objectives.

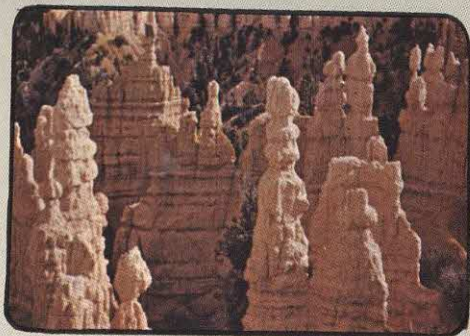


Color Plate 3. At the top left is a frame from the filmstrip series, *Insects*. Shown is a Lady Bird larva eating aphids. At right is a scene from the motion picture, *Medieval Knights*. At the middle left, from the film *Egypt and the Nile*, is a striking view of action at Alexandria Dock, and at right is a frame showing a frog singing, from the *Classification of Living Amphibians and Reptiles*. At lower left is a view from the experience-centered films of the *Je Parle Français* teaching system. (Courtesy Encyclopedia Britannica Films, Inc., Wilmette, Ill.) At the lower right is shown a scene of two women grinding grain from the film, *Philippines: Nation of Islands*. (Courtesy United World Films, New York, N.Y.)



Color Plate 4. At top left is shown a scene from the motion picture, *Michelangelo and His Art*. Middle left and lower right scenes, respectively, are from the films, *African Continent: An Introduction*, and *African Continent: Southern Region*. (Courtesy Coronet Instructional Films, Chicago, Ill.) At the top right are strips of frames from two filmstrips, *The Language of Sets*, and *The River Cultures: Egypt*, and at the lower left is a color reproduction of a 2-inch by 2-inch slide of the pinnacles in Bryce Canyon from a set titled *National Parks*. (Courtesy Society for Visual Education, Inc., Chicago, Ill.)

1930 PINNACLES, BRYCE CANYON



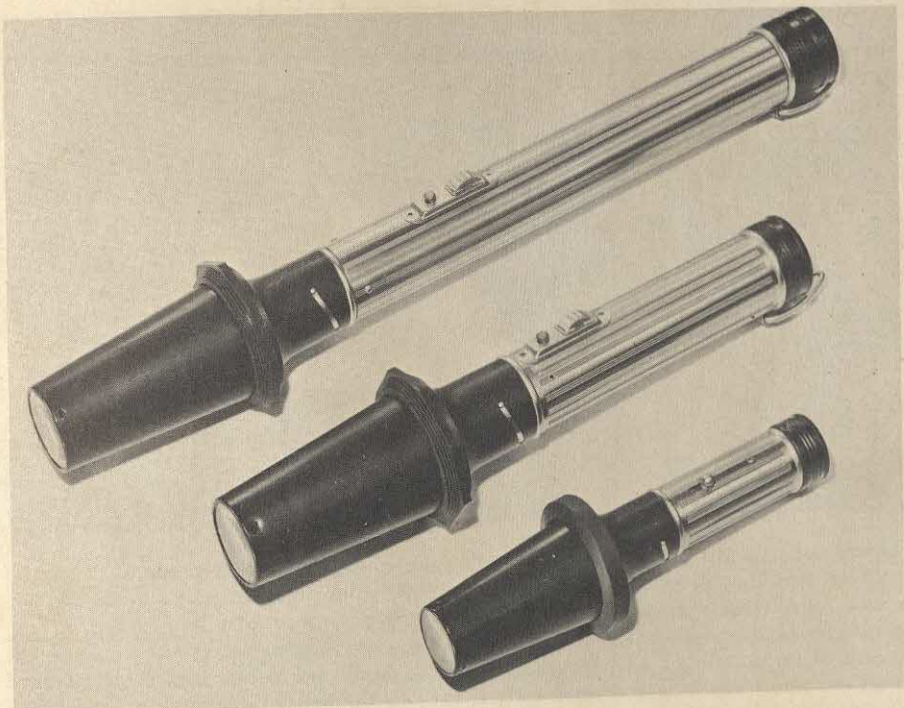


Figure 5-6. These battery powered electric pointers permit the teacher to guide student observation from projectors at the rear of the room. Teachers, of course, may remain at the screen if they have remote control cords and devices, or if they operate automatic projectors at the front of the room. (Courtesy E. Leitz, Inc., New York, N.Y.)

5. Selecting a film clip of about 50 to 100 feet of extremely appropriate and significant content, thus skipping all other remaining content.

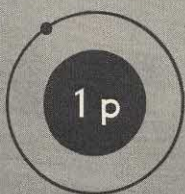
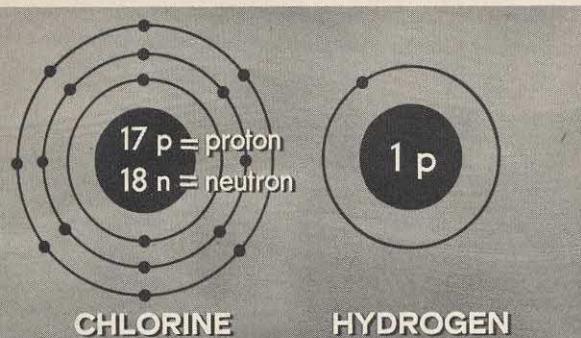
Despite the variety of ways for running off a motion picture, it should be emphasized that teachers may destroy the impact of continuity and action if they chop up the projection process without good reasons.

When teachers have light dimmer controls they should dim lights during the time they are making introductory remarks, and, after the film showing, they should plan to return general illumination to normal brilliance gradually to prevent discomfort and distraction.

Teachers also need to estimate correctly the running time of films and film sequences to allow time for conducting introductory and follow-up activities as required by their objectives.

FILMSTRIPS

When filmstrips are accompanied by tape or disk-recorded commentary, the presentation will probably continue from beginning to end without interruption. However, many instructors prefer to select certain



The modern concept of the atom is difficult to diagram. Most texts use a simplified "solar system" atom.

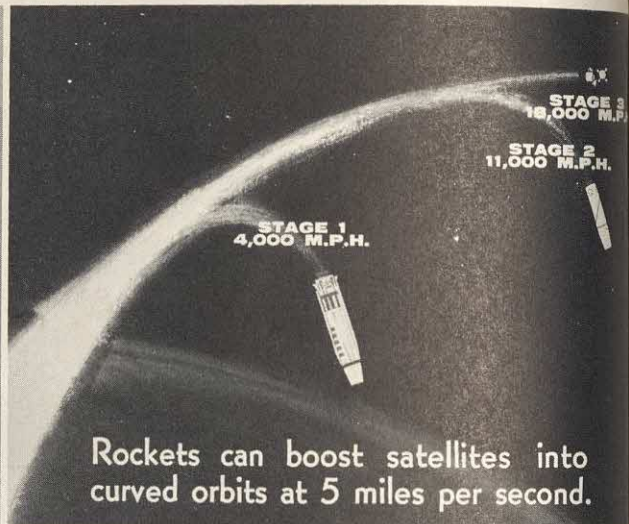


Figure 5-7. Filmstrips are sources of valuable pictorial and diagrammatic material such as drawings, diagrams, maps, pictures of museum objects and models, re-enactments, and actual photographs. Accepted by pupils, and thus highly motivating, problems should be the basis for filmstrip use; however, filmstrips are also an excellent means of introducing a unit of work. Teachers should use the frames creatively and read the frame captions and notes only if they fit the teacher's reason for presenting the material. These filmstrip frames are from the *Chemistry for Today* and *Space and Space Travel Series in Color*. (Courtesy Society for Visual Education, Inc., Chicago, Ill.)

Figure 5-8. These pictures are from the filmstrip series, *Classification of Living Fish*, for the high school biology program. Filmstrips in this series are in color. The lamprey shown in the picture is from *Primitive Cartilage Fish*. The filmstrip content includes as a close-up the lamprey's suckerlike mouth. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)

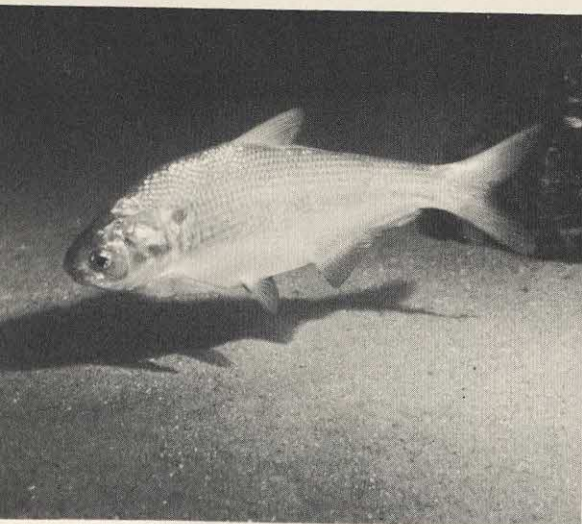




Figure 5-9. Filmstrips are being increasingly used in self-instructional processes. Special filmstrips may be made for special instructional processes and for special models of teaching machines, or any one of the thousands of available subjects may be viewed on individual viewers as shown in this junior high school classroom. (Courtesy Board of Education, Westport, Conn., and George E. Ingham.)

pictures from a filmstrip, and completely eliminate all intervening, irrelevant, and insignificant content. During the skipping process, light may be dimmed to minimize distraction of the viewers, by placing part of the hand over the lens barrel, while the chosen picture is being turned into position. The precaution should be taken to prevent putting smudges on the lens by touching it. A small card with a small hole in it to let enough light through to barely see the frame content may also be used by the operator. Teachers need to conduct participatory activity for each frame, questioning and explaining as the content demands in the light of the *action* principle presented earlier in Chapter 3. This latter advice is also applicable to the selection and projection of a set of slides.

INSTRUCTIONAL TAPES

There are several vastly different ways of putting the tape recorder-player to work, and, operationally, teachers need to employ different techniques. *The first technique* is to play a taped audio program for the class under the guidance of the teacher, in the same manner as a phono disk or a motion picture is presented in relation to a pupil problem, as an introduction to a topic or unit, as a part of a lecture or an explanation, or as a vicarious travel experience to a foreign country. A taped music lesson with piano accompaniment, a tape-recorded interview with a local banker, and a dramatization of a Shakespearian play are a few examples.



Figure 5-10. These students have "gotten their man" on tape. Students can carry an alternating current or battery operated tape recorder to any office building and get first-hand information in a personal interview. Thus the tape recorder becomes an instrument that lends itself for some unique pupil activities. The tape recorder does some wonderful jobs for the teacher like becoming a piano for song accompaniment, becoming a diagnostic instrument for speech defects, becoming a substitute for a teacher who cannot carry a tune, a recombining mechanism for selected excerpts of other tapes and disks, and becoming the voice and arm of the teacher to present instructional sequences—to mention just a few. (Courtesy 3M Company, St. Paul, Minn.)

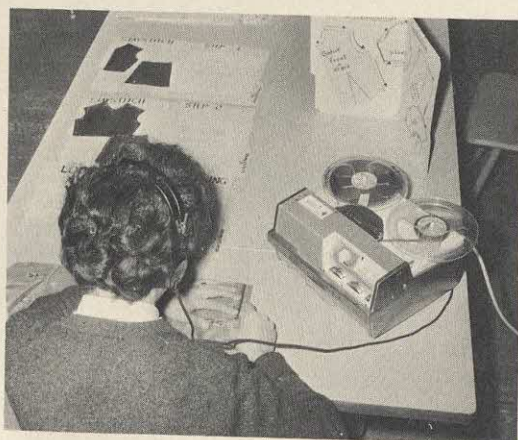


Figure 5-11. This tape recorder is part of a teaching system being tried out in home economics. The teacher has prepared descriptive visual panels that provide step-by-step instruction for construction processes. The tape-recorded component guides the student in his study and action. This student is using headphones, hence other similar self-instruction stations are usable in the same laboratory or workroom. (Courtesy Ithaca City School District, Ithaca, N.Y.)



Figure 5-12. In this view of a conventional size typewriting class, tape-recorded instruction is given to a selected group of students on rotation while the rest of the class is working other assignments. Note the simple facilities that make such special instruction processes possible. Refer also to Figure 1-19. (Courtesy Edwin O. Smith School, Storrs, Conn. Photograph by the author.)

The second technique is to use a recorded tape as an extension of the teacher's presence and guidance, that is, employ a tape recorder-player to play an instructional tape made by the teacher himself to be used in a small or large group while the teacher is at work in another area. Hosts of possibilities for both large and small groups, for team or regular teaching situations, present themselves. Such taped content may call for written or spoken responses by the students, may refer students to pictures or diagrams in textbooks, or to filmstrip frames and slides in individual viewer devices. Some of the technological developments for carrying on such activities have become quite complex, and such operations are frequently carried on in specially equipped rooms. For example, the now familiar language laboratories, or more broadly applied, the electronic learning laboratories, make use of the teacher's own voice and guidance in precisely planned exercises, and it should be emphasized that this same operational procedure may be applied in all teaching fields. Hence it becomes obvious that the language laboratory in broader use should be



Figure 5-13. The electronic learning laboratory (first called language laboratory) has virtually become standard equipment for language instruction since 1956. These pictures show details of the Dialog System. Teachers need to identify clearly their teaching objectives, design and prepare appropriate tape-recorded self-instructional materials, and then combine all instructional components into a system of instruction. The close-up view indicates that the student dials a number to activate electronically the various taped programs and recording and/or playing processes. (Courtesy Chester Electronic Laboratories, Inc., Chester, Conn.)



called an electronic learning laboratory, or audio listening-response center. Thus the tape recorder may be fitted with a special extension cord or channel or a multiple headphone box into which headphones may be plugged in the simplest installations, or the tape recorder may be connected up with master consoles by either wireless or conventional circuitry in a more complicated fashion. Then by dial telephone or other arrangements, any given exercise or presentation can be selected manually or automatically, played back, used, and stored for the future.



Figure 5-14. This inexpensive language laboratory (electronic learning laboratory) is an overhead installation which utilizes regular classroom areas. (Courtesy Switchcraft, Inc., Chicago, Ill.)

Some electronic learning centers are operated in each classroom by simply plugging the tape player into a headphone plug mold, or channel, as a part of a long worktable arrangement, thus splitting the class into two or more groups for special instruction, or combining classes into larger groups as needed. In such simple installations the pupil responses are generally of the written or whispered type, depending upon the activity, or the presence of surrounding groups of pupils. By having pupils take turns at a microphone, voices can be recorded in sequence for future evaluation by the teacher. However, on one headphone channel, only one voice can be recorded at a time if the result is to be intelligible.

A third technique is to use the tape recorder to record project activities of students. Students may write, rehearse, and record a play using the classroom as a production studio, record a rhythm band selection, or record a class discussion.

Specific Teaching Practices. Operationally, then, the teacher may have to engage in the following characteristic practices:

1. Prepare such instructional content for recording on tape as explanations and questions.
2. Select pictorial references and prepare work sheets as needed.
3. Record the content before scheduled use by the class.
4. Decide how to fit the private listening and responding by pupil groups into the overall instructional plan.
5. Arrange for a tape machine operator or personally check speed and volume of the tape player.

6. Arrange for extra microphones or extension cords and/or extra headphones.
7. Ascertain if all headphones are working properly at all listening stations.
8. Evaluate the oral or written responses of pupils or otherwise assess progress.

TRANSPARENCIES

If given a good line-drawing transparency in single- or multiple-overlay form and a good overhead projector, the teacher has two operational concerns of a physical nature that demand specific teacher action, namely, (1) keystoneing, and (2) preventing himself from blocking view of the image on the screen. Keystoneing results when the projector is lowered to prevent blocking the image. If the projector is placed on a high stand near the front of the room with the teacher standing up facing the class, some of the viewers, even with the projector in a center aisle, are likely to be blocked from a view of the screen.

Keystoneing, that is, a picture that is wider at the top, like a capstone rock in an arch, may not be detrimental in all learning situations. In those cases where students observe and remember distorted images, keystoneing would be extremely objectionable. The distortion of images may also prove to be a serious distraction. Teachers who use overhead projector transparencies should frequently insist on the elimination of this projection condition. Installation of a tilted screen is the common solution to the problem. Projection to a mirror reflecting into a rear projection screen is another, although relatively expensive, means of eliminating the keystone effect.

In summary, teachers should (1) sit down at the projector while operating it, and (2) eliminate keystoneing by tilting the screen if distortion of images is a critical matter.

When transparencies are of the sprayed, etched-plastic type, having crayon-applied color and soft-lead pencil lines for the image, or when they are of the picture-lifted type, the room may have to be darkened to facilitate effective projection. In general, for line-drawing type transparencies, such darkening is not necessary.

When teachers wish to use the transparency as a substitute for the chalkboard by sketching and writing on an acetate surface, they should consider using acetate sheets instead of acetate rolls to facilitate their reuse. When acetate sheets are mounted by taping them to inexpensive mounting frames, they may be controlled more easily on the projector.

Techniques for preparation of transparencies are presented in detail in Chapter 6.

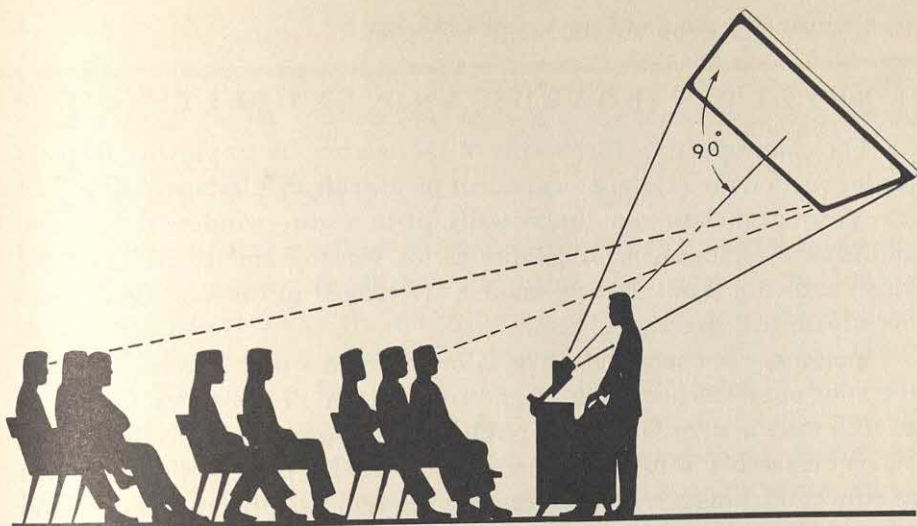
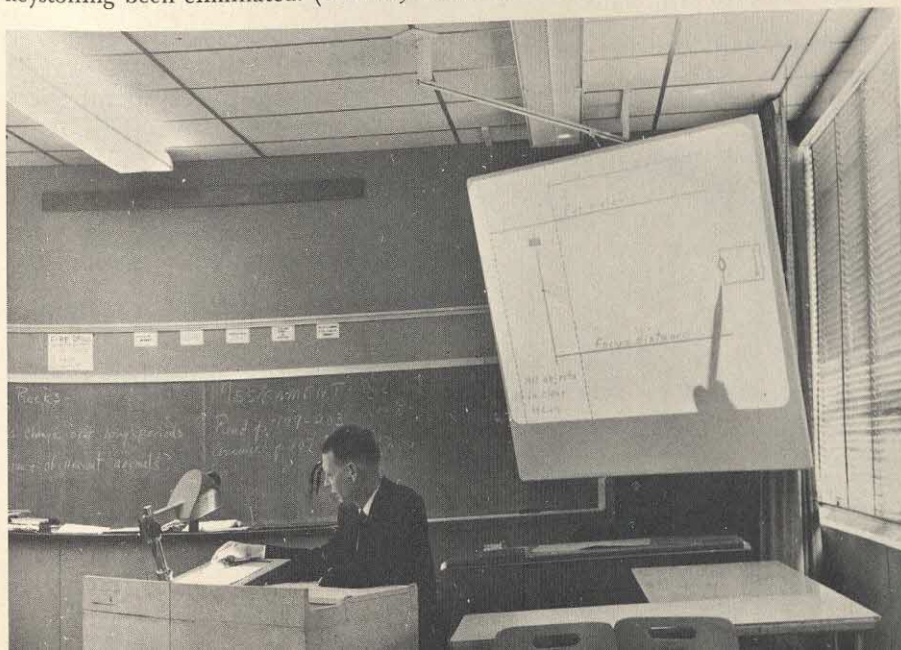


Figure 5-15. When overhead projectors are located below the level of a projection screen the screen must be tilted if keystoneing is to be eliminated. Line of sight to the bottom of a projected image must also be unobstructed or shadows will be seen in the projected area. Some classrooms do not have ceilings high enough to make possible the conditions shown in this diagram. What three conditions can be identified here? Is the axis from the objective lens to the center of the projected image perpendicular? Is the line of sight of viewers to the bottom of the projected image unobstructed? Is the teacher's head, when standing up, above the line of sight of viewers to the bottom of the projected image? Put a piece of tracing paper or clear acetate over this diagram and sketch in a new lower position for the screen preserving favorable line of sight conditions for viewers. What must the teacher do in your new situation? (Courtesy Tecnifax Corporation, Holyoke, Mass.)

Figure 5-16. Study the projection situation in this picture. Identify the ceiling-mounted track for tilting the screen. This screen may be lowered or raised by a cord and pulley system. Note the ceiling-mounted traverse darkening system with light diffusing Venetian blinds. Can you visualize what would happen if the teacher were to stand up while presenting his transparencies in his present location? Has keystoneing been eliminated? (Courtesy Board of Education, Greenwich, Conn.)



BULLETIN BOARDS AND EXHIBITS

The chief operational concerns of the teacher in employing displays for instruction are (1) the procurement of suitable display space in school corridors or on classroom display walls, or in a store window downtown, and (2) the arrangement of conditions for viewing and reacting by the target audience. Both of these matters are related to the way the display fits into the overall teaching plan.

Sometimes teachers undertake to organize all study activities around the joint pupil-teacher planning and construction of a display. Generally in such cases a larger and more public display surface or area is needed. When the teacher himself constructs the display for presentation to pupils as a direct teaching activity, the teacher's job is to assemble the content and arrange it so as to achieve the teaching purpose set up in advance. Such bulletin boards would then be displayed solely for his class and hence in the classroom. In corridor display situations, viewing activity will take place while classes are passing as an informal activity. In the case of teacher preparation and presentation, viewing will have to be formally arranged. The following are possibilities. The teacher may:

1. Refer to the headline of a display and to the content that may be seen and interpreted.
2. Cover display by one or more sheets of wrapping paper and remove it at the proper time.
3. Open up or refer to display after raising one or more questions requiring thoughtful responses in written form and ask students to move up for close observation and study, five or six, even a dozen, at a time.
4. Ask students to study display and answer a set of questions during free time, or after school.

Operationally, teachers need to guide pupils in setting up displays as an exercise in good communication, and they should never spend their

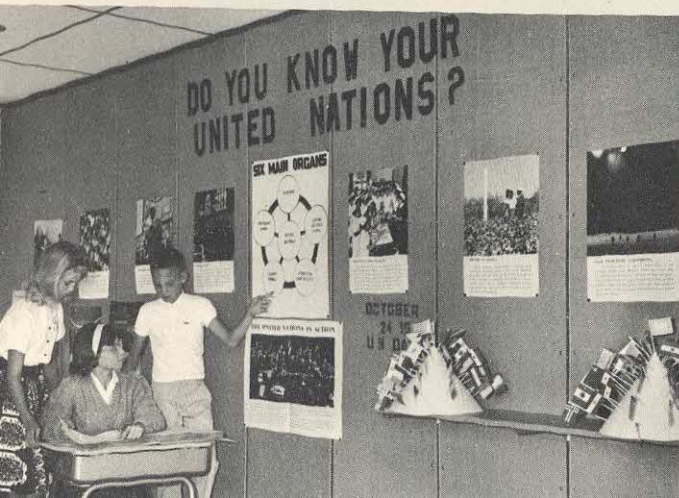


Figure 5-17. Planning and constructing this corridor display must have been a challenging class activity calling for intensive study. The teacher in such activity is a co-worker, an expeditor, a guide, a leader. Refer to *Bulletin Board Displays* in Chapter 6 and suggest one or two additional headlines in line with instructions there. (Courtesy Public Schools, Kalamazoo, Mich.)

own precious time in constructing displays of a trivial nature. A terse discussion of display construction principles is presented in Chapter 6.

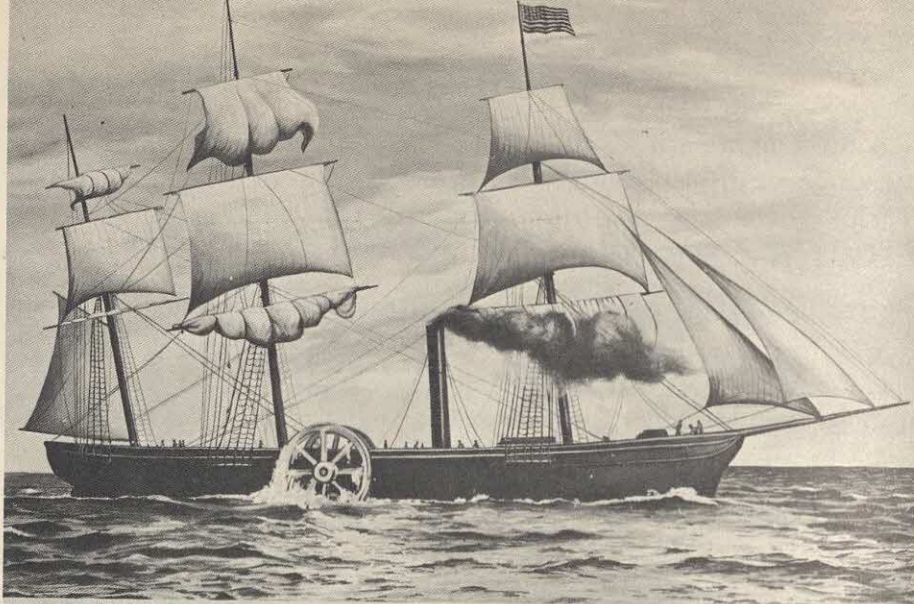
STUDY PRINTS

The educational potential of any given illustration resides in the nature of the contact between learner and picture. Such effective contacts are operational features that are too frequently omitted by even experienced teachers. Just how does a teacher arrange to have pupils make significant contact with a picture? And what contact is significant? Significant contact, as with any other material or device, is a contact that calls for observation, recall, comparisons, judgments, inferences, and conclusions, leading to solid generalizations; or a contact that provides the pupil with a set of illustrated directions for carrying on a specific and worthwhile performance. The one guiding principle is to *get action by asking questions*. Just how can teachers arrange efficiently for these necessary pupil contacts? Here are some suggested teaching practices:

1. Guide students by asking questions, small and large step questions as the teaching objective demands. Put questions on the chalkboard or on ditto sheets.
2. Put the set of study prints on a study or worktable and ask groups of students to work on designated questions and report to the class at a scheduled time.
3. Fasten pictures to a display wall or hang them by card holders or paper clips on a stretched wire at *eye level*. Pictures may be fastened to display surfaces with staples, thumbtacks, and pins, none of which have to pass through the paper.
4. Display pictures in optimum learning sequence with one or more crucial questions typed on sheets hinged to the back of each picture. Pictures may be subsequently displayed with or without the question being visible.

Teachers are cautioned not to display pictures above the top of the chalkboard as is done so many times. Any action of this kind is to be construed as a desire to decorate the room without teaching objectives in mind. It should be known that the *study print*, sometimes called the *flat picture*, has a significant role, and that the teacher should be competent enough to implement this role, which is the accomplishment of identifiable, valid educational objectives.

Because of its wide application to the utilization decisions for all pictorial materials, both motion and still, teachers should be cognizant of various levels of mental activity that characterize the study of pictures. Teachers are naive indeed if they believe that simply to *look* at a picture



The Steamship "Savannah"

In 1819 the "Savannah" crossed the Atlantic Ocean. She was the first vessel to use steam power on a transatlantic voyage. To save her small supply of fuel, sails were used most of the way.

AMERICAN TRANSPORTATION

PLATE 26

INFORMATIVE CLASSROOM PICTURE PUBLISHERS

GRAND RAPIDS, MICHIGAN

Figure 5-18. Observation of these pictures of the Savannah and the United States from a set on *American Transportation* reveals the sweep of history and the strides in advancing technology. How best provide for pupil contact with such materials? How can appropriate responses be called for? These are decisions that teachers have to make every day. See basic principles in Chapter 3. What roles may such pictures play? (Courtesy Informative Classroom Picture Publishers, Grand Rapids, Mich.; H. Robert Armstrong, Photography, Philadelphia; and the Peabody Museum, Salem, Mass.)



An Ocean Liner

The steamship "United States" is one of the world's largest and fastest ocean liners. It weighs over fifty-three thousand tons. On its first voyage, in 1952, this ship sailed from New York to England in less than 5½ days.

AMERICAN TRANSPORTATION

PLATE 27

INFORMATIVE CLASSROOM PICTURE PUBLISHERS

GRAND RAPIDS, MICHIGAN

is to *use* it. Therefore, what kinds of mental activity, kinds of responses, to use another term, may well be basic to the effective observation of pictures? In a frequently quoted article Bartlett made the following analysis:

. . . it is clear that several distinct levels of response exist. These stages are: (1) naming objects, (2) grasping import, (3) observing details, (4) relating the picture to experience, (5) drawing inferences, (6) adding imaginative elements, and (7) engaging in further activities suggested by the picture.¹

This analysis reveals clearly how the naming of objects, or differentiation, leads to synthesis, which leads to more differentiation and synthesis, and, as the pupil's own experience leads him to make inferences, he integrates ideas, reacts more intensely by using his insights, and perhaps defines new problems beyond the scope of the picture. Then, of course, is the time for the process of generalization as a natural result of all responses.

Figure 5-19. This picture of *Life on a Flatboat* is from the set *Pioneer Days*. This drawing focuses attention on relevant details. The implied action gives this picture a potential for pupil experiencing. Study this picture in connection with the exercise in using various levels of mental activity. (Courtesy Informative Classroom Picture Publishers, Grand Rapids, Mich.)



To illustrate this process we can apply the seven levels of response to a particular picture and we ourselves can carry out the mental activity suggested. Let us study the picture, *An Ohio River Flatboat* (Figure 5-19) from the set, *Pioneer Days*,² and get a cross section of responses as follows:

¹ Mary M. Bartlett, "Early Stages of Picture Reading," *Teaching with Pictures* (Grand Rapids, Michigan: Informative Classroom Picture Publishers, 1943), p. 10.

² Published by Informative Classroom Picture Publishers, Grand Rapids 2, Michigan.

MENTAL ACTIVITY IN THE STUDY OF PICTURES

<i>Levels of Response</i>	<i>Examples</i>
1. Naming objects in the picture.	River, rudder, man, woman, plow, tub, boy, chicken.
2. Grasping importance of the picture.	Living on a flatboat, or traveling on a flatboat.
3. Observing relevant details.	Plow is fastened to boat. A little girl at the stern with the cow. The woman is cooking.
4. Connecting the picture to our experience.	Have we been in rowboats, motor boats, in canoes, in cabin cruisers, in sailboats, on ocean liners? Have we been on a river with the current, against the current?
5. Making inferences.	This flatboat is never going back. This is a family and the family is moving to a new home. (Can we infer temperature, Season of the year, weather, sound, odor of cooking, movement?)
6. Adding imaginative elements to picture content.	Where is this family going? What might the mother be cooking? Why might these people be moving to a new home?
7. Engaging in extended study activities.	Investigate the following: What rivers did flatboatmen travel on in pioneer days? What direction did this travel take (that is, on a particular river)? Make a mural based on map study. About how long is this flatboat? When the boat arrives what might the lumber be used for? Analyze the characteristics of successful pioneers and visualize them in a series of posters that are applicable to life today.

We can state with considerable assurance that unless pupils engage in, as objectives determine, vigorous mental activity with pictures, they will be likely to engage in only a general perusal, leading to the faulty idea that they have in fact studied the picture and have no further need for observation. It has been emphasized before that teachers need to *get*

action with pictures. This calls for guidance through thought-type questions. Such questions are the means for eliciting desired responses from pupils.

When we have good study prints, and we as teachers desire to make good use of them, we should guarantee good results by following the basic principles for all audiovisual media set forth in Chapter 3. We should also consider which of the basic roles, as described in Chapter 1, we desire our study prints or other illustrations to play in our teaching and in the learning processes of pupils.

TELEVISION PROGRAMS

There are three basic situations in which television programs are used in school. They are as follows:

1. A television program of educational value is to be received at home. The teacher is aware of it, and has made a significant assignment calling for student observation, study, and conclusions, as a part of formal teaching activity. Such programs may originate in both commercial and educational sources.
2. A scheduled, announced in advance, television program, designed for school use, is to be received in the classroom. Such programs are generally produced by a state-wide or community educational television station.
3. A series of scheduled, announced in advance, television programs, designed as a part of or as a whole course, is to be received in designated classrooms. Such programs are generally produced by the television center, owned by the school system, operating on a closed circuit or low-power open-circuit basis.

These three situations obviously demand different teaching practices. In the first case, namely, home viewing, the teachers must find a way to:

- (a) Know what programs are being telecast, and what the possible contributions of such programs might be to elementary or secondary school subjects, activities, and objectives.
- (b) Plan for a discussion of reactions to program content and use such program potentials as the basis for writing, critical judgment, or future assignments and projects.

In the second case the teacher has a chance, presumably through published program-content booklets, to learn of planned and scheduled telecasts. Therefore operationally, in a teaching sense, the teacher must:

- (a) Ascertain what the system-wide agreements are between school curriculum leaders and the teaching staff. An example would be to ascertain if all teachers have agreed to and planned for the use of all programs as scheduled, or if teachers may exercise choice in how and when such programs will be employed in their classrooms.
- (b) Familiarize himself with the program content, and plan for expert utilization in the light of course objectives, as he would do for a motion picture, set of slides, a prerecorded tape, or a filmstrip.
- (c) Plan precisely for the timing of the reception and the integration of follow-up, including pretuning and checking the receiver for adequate signal strength in advance of the starting time.

In the third case, the teaching practices may be identified, discussed, and agreed upon within the school system. Therefore it is possible to know in advance the roles that will be played by both the television teacher and the classroom teacher in making effective use of program content in classroom operations. This locally owned and operated closed-circuit television is probably the most efficient and creative way to capitalize on the potential of instructional television. It is relatively more expensive, but it permits creative reorganization of instructional patterns into large- or small-group activities. Thus for the third case the specific teaching practices are the same as stated under the second. However, since all programming is under complete local school-system control, the classroom operations are greatly facilitated. Moreover, teachers are likely to have assisted in making the original plans, and thus are more likely to be in a position to make creative decisions. The way one school system worked out the responsibilities of the classroom teacher in its instructional television program is introduced in the next paragraph.

In cases where classroom teachers assume control of related instructional activity after scheduled telecasts they must basically carry out the designs originated by the television teacher. There are several major aspects of this work, and, although their actions are directed by means of teaching outlines, their job is rather complex. In the direct television teaching project in the Anaheim City Schools of Anaheim, California, an excellent television guide for teachers explains the system of teaching practices and sets forth a detailed listing of responsibilities for the regular



Figure 5-20. These pictures show a studio teacher telecasting a language program for first grade classes, a classroom group receiving a United States History telecast, and the optical multiplexer and camera equipment at the TV station that makes possible the instantaneous use of film clips and slides in program content. Both studio and classroom teachers utilize a wide variety of media in carrying out their instructional roles. (*Top picture courtesy WQED Channel 13, Metropolitan Pittsburgh Educational Television; and bottom pictures courtesy Board of Education of Washington County, Hagerstown, Maryland.*)

classroom teacher. This list is so well organized and comprehensive and so potentially valuable that it is quoted here in full: ³

RESPONSIBILITIES OF THE CLASSROOM TEACHER

Physical Climate of the Classroom

Temperature and ventilation.

Lighting (best placement of television set).

Tuning of set (check glare on sets from pupils' eye level). The set should be left on until telelessons are completed for the day.

Elimination of distractions.

Efficient distribution of materials.

Seating arrangements.

Orderly movement of groups to and from the classroom, and within the classroom.

Definite procedures for such organizational necessities as taking attendance, distribution of papers, leaving the room, sharpening pencils, etc.

Meeting Individual Needs

Provide proper placement of pupils with physical problems.

Be aware of the ability range within the classroom and provide for in the "pre" and "post" lesson experiences.

Clarify and adapt assignments to extend and enrich the learning of each individual within the group.

Before the Telelesson

Evaluate learning activities which pupils are developing.

Thoroughly read and study telelesson guide sheets for each lesson. Know the scope and sequence of each unit and how each telelesson is correlated with scope and sequence guide.

Prepare and have available all materials, texts, etc., for pre-telelesson preparation and related teaching activities in advance.

Create a readiness for learning; discuss lesson and its purpose, what pupils may expect, what they will learn. Introduce new vocabulary.

Organize the classroom so that distribution of materials to be used during telelesson is made before the lesson; television sets are turned on and adjusted,

³ By permission, *Instructional TV Guide*, pp. 16-20, Instructional Television, Anaheim City Schools, Anaheim, California. Robert H. Shanks, Superintendent of Schools; James D. Brier, Director Instructional Television.

drapes pulled, pupils seated properly, and all materials other than those needed during the lesson are out of the way to avoid distraction.

Watch the time and schedule closely so that the pre-lesson activities are presented thoroughly.

Develop a method in classroom for handling questions asked by the studio teacher.

During the Telelesson

Help pupils who need individual help during a work-type lesson.

Take notes. (Teacher's notes can be used to emphasize main points of the lesson and as a guide for discussion following the lesson.)

List vocabulary for further definition and discussion.

Observe pupil reaction throughout lesson; make notes of any reactions valuable to the studio teacher. Handle behavior problems immediately.

Move about the room to see that pupils understand and are using materials properly.

Give pupils additional directions when necessary during the telelesson.

Become enthusiastic—answer questions asked by the studio teacher during the presentation—if the teacher is enthused and participates, the pupils understand that they are a part of the lesson and should respond to the studio teacher.

Encourage “controlled” overt responses to ideas and questions raised during a lesson. The studio teacher indicates by the way questions and ideas are presented, the type of response that is expected of pupils observing. (He may say, “What famous man, that we have heard about before, died at the Alamo?” He may say, “Can you *think* of other types of plants that adapt to their environment in a different way?” The first question should be answered audibly by pupils in the classroom with the teacher guiding and encouraging the response. The second question requires a covert response from each pupil which the classroom teacher may wish to bring up after the telecast for further discussion.) Types of response that detract from the intimacy of the studio teacher-pupil relationship should be avoided. (The studio teacher might state, “Let’s *think* about why the pioneers went west.” The classroom teacher responds, “Mary, what do you think?” Mary may or may not give a correct response. The teacher in the studio cannot anticipate the timing for an oral response to this type of question and the attention and rapport existing between studio teacher and pupil is divided during the discussion in the classroom.) *Participation is an important factor in learning*; it must be developed, encouraged, and controlled by both studio and classroom teacher working together during the telecast.

After the Telelesson

Check pupils’ understanding of concepts presented by studio teacher. Stress areas of the telelesson that need re-emphasizing.

Re-teach in area where there is lack of understanding in relation to ability levels.

Check to see that new vocabulary is understood.

Organize class into established groups to summarize lesson and to coordinate and carry out further learning activities.

Use suggested related classroom instruction activities for group work extended over a period of time. Correlate the activities from lesson to lesson so that continuity is established.

Guide discussion according to concepts and understandings which pupils should gain from the telelesson.

Provide experiences to enable the pupil to more fully understand and apply concepts presented.

Provide enrichment activities to meet the special needs and interests of pupils.

Encourage pupil reports of supplementary activities such as experiments, projects, reading reports that grow out of telelessons. Pupil participation is essential to effective education. Participation by using ideas in assignments, projects, discussion and research stimulate active responses so important to good education.

Check pupils' notebooks to assure their maximum value. Folders should be provided for storage of related materials.

Encourage the method of having pupil rise and face the group when speaking.

Guidance, Encouragement, and Assistance to the Studio Teacher

Complete and send to studio teacher telelesson reaction sheets and evaluation reports.

Give constructive criticism at meetings, personal conferences, or by phone—let studio teacher know *what most interests pupils—what teaching techniques “pay off” in learning.*

Give recommendations for future lessons.

Share materials and projects developed by teacher and pupils.

Professional Support

Give support to the television project in contacts with pupils, parents, teachers and general public.

Give professional support to the efforts of the studio teacher.

All of this is an enormous demand; yet the beginning teacher is reminded that the studio teacher also has responsibilities, one of which is to provide detailed guides for the classroom teacher. Thus the task that appears immense in the previous listing is carried on with the significant assistance of other originators and planners.



Figure 5-21. Programed textbooks are vastly different from conventional textbooks in the manner of presenting information and in the kind of control they exercise over the responses of the learner. Programed textbooks are in a sense a kind of teaching machine without hardware. Students in this experimental group are using these programed books on the assumption that they were prepared by their teacher. (Courtesy Board of Education, Westport, Conn., and George E. Ingham.)

TEACHING MACHINES

Curriculum planners and their teaching staffs need to plan in advance effective teaching practices for using all kinds of teaching machines. It has already been mentioned that not all so-called teaching machines are characterized by hardware. In fact, programed textbooks are also teaching machines, and, instead of pupil control by electro-mechanical hardware, the pupil himself must turn a page or look in a designated place normally not in view to seek a correct answer before proceeding to the next learning step.

Instruments for presenting motion pictures, filmstrips, slides, recorded tape, and the like may have to be used in conjunction with teaching machines to orient pupils to the work that lies ahead, prepare them by providing standardized vicarious experiences, and actually serve as reference



Figure 5-22. This class group is working on a programmed course. Refer to Figure 2-44 for more details. Teachers need to be ready to assist pupils in their deliberations as needed. Programed responses are only one component of the instructional effort. What other professional activities besides pupil management must this teacher carry out? (Courtesy *Encyclopaedia Britannica Press, Chicago, Ill.*)

panels for specific program items. Or these instruments may be used to present the programed frames to the whole class at once under the guidance of the teacher, instead of using a machine-to-person system.

A battery of machines employing electro-mechanical levers as would a room of adding machines, might cause considerable clatter as pupils work through a program. The level of noise, therefore, may actually be a problem, especially where multi-group activity is being carried on at close quarters. In these cases a special machine room, as has been recommended for language and other electronic learning laboratories, should be provided and used on schedule. Target groups may be conventionally sized classes, or smaller groups may be combined or reorganized into new and larger groupings for the tutorial work with machines.

Teachers will have to decide themselves, or carry out procedures already prescribed, how best to introduce programed learning sequences, when to start them during the period, when to discuss them with the pupils, and when to give help to pupils. They will also have to determine the optimum length of the work periods with machines and how best to balance the effort and time spent on programed sequences with the effort and time spent on the creative, productive, individual group projects, such as conducted in libraries, outside of the school, and in science and home economics laboratories. Homework is another operational feature



Figure 5-23. In this view the MTA 100 Teaching Machine is set up to be used with a tape repeater and a Dukane Filmstrip Viewer. How would the visual panel and the voice be likely to help the student? (Courtesy Modern Teaching Associates, Inc., Milwaukee, Wis.)

of the use of teaching machines since programs may well be assigned for out-of-school completion.

Teaching practices characteristic of the teaching-machine medium therefore involve a host of decisions not only about physical facilities and scheduling, but also about how to fit programed sequence study into an instructional system to achieve a broad range of educational objectives. It is the nature of these objectives that will determine what the teacher will have to do to guide pupils before and after or during work on programed sequences. Programed sequences may assume varying degrees of importance in the teaching of course content and in preparing pupils to use the abilities that they are learning functionally, as in social studies, science, mathematics, and language arts.

In all of the teaching machine operations where the tutorial process of a machine for each student is the system being used, the teacher must be prepared to organize a program of activity geared to course objectives for individuals completing the programed sequences at different times. Such programs of activity call for the preparation of a number of challenging problems described on ditto sheets or maintained in card-file form for students to work on in accordance with their interests and needs on a voluntary basis. Additional work on program sequences of a related nature, special laboratory work, wide library reading, and community study and work experiences are of course other possibilities. This is precisely what

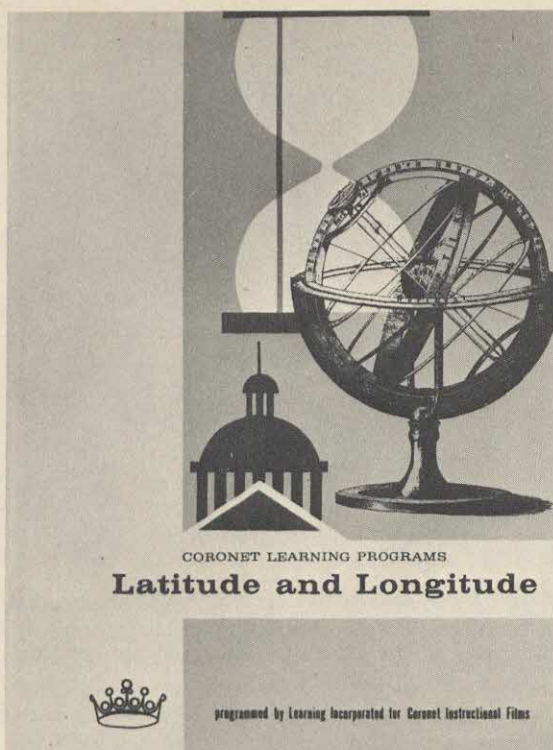


Figure 5-24. Programed learning sequences may be short or long. They may be parts of courses as a teaching unit, or a subsidiary process within a unit. They may be in the form of a whole course as Algebra 1. Shown in this cluster of pictures is a cover page and one item from a *Coronet Learning Program* on the topic of *Latitude and Longitude*. Teachers may arrange conditions so that programed sequences may be worked on as homework assignments. (Courtesy Coronet Instructional Films, Chicago, Ill.)

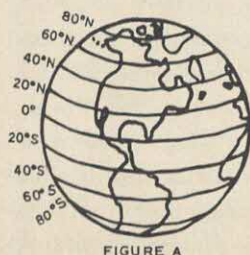


FIGURE A

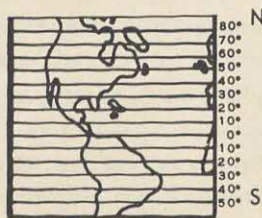


FIGURE B

5-10 Maps and globes often do not have a line for each degree of latitude. On the globe above, every 20th degree of latitude is shown, while on the map every (?)th degree is shown.

is meant when it is said that teachers will have time for more creative activity. Such creative activity will be in the nature of planning and guiding creative work by groups and individuals, constructing better evaluative tests and scales, preparing supplementary programed sequences and pupil guide sheets, preparation of special reading lists, planning and preparing unique visualized presentations for problem definition, motivation, and/or summary, and critically scrutinizing the responses being made by pupils

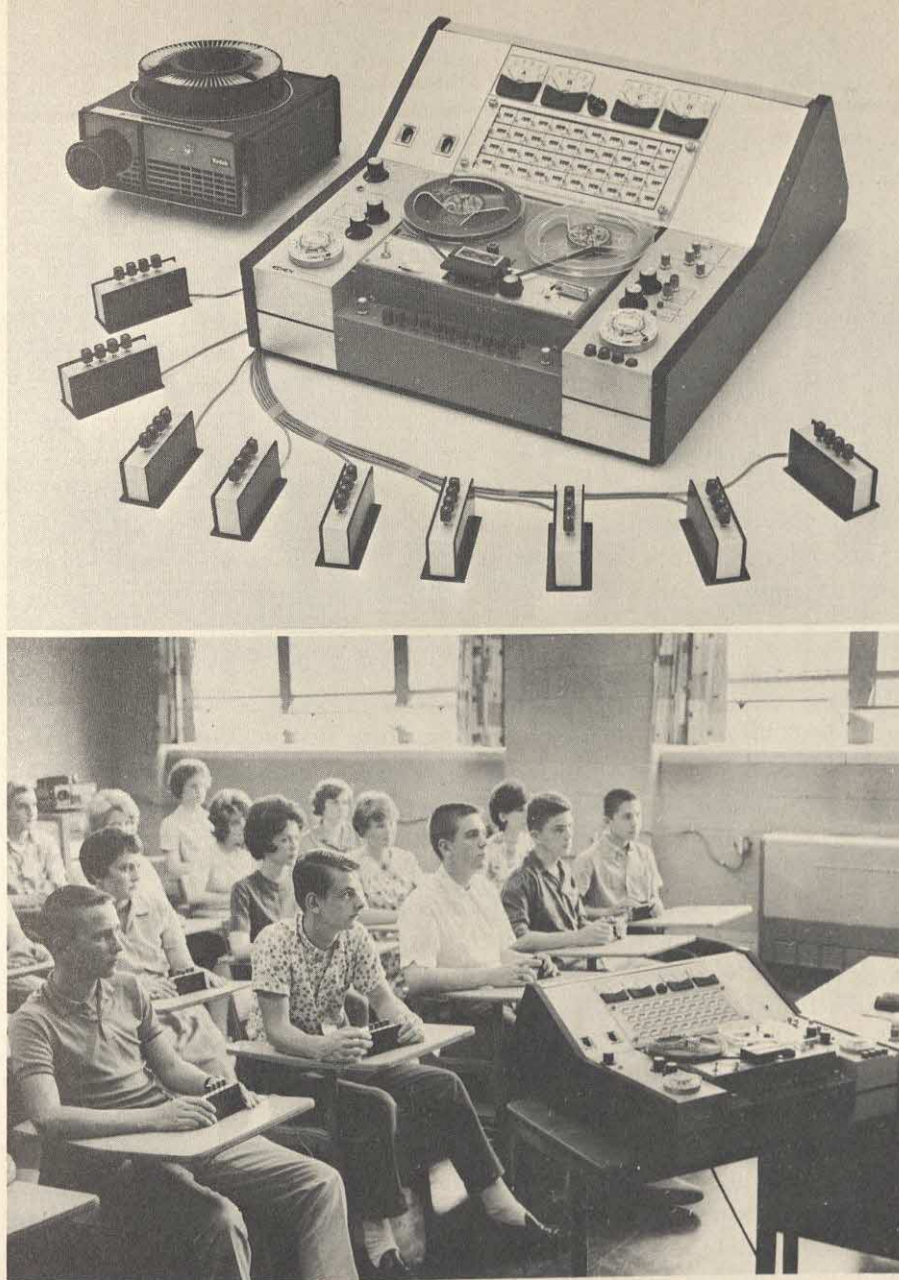


Figure 5-25. The Edex Teaching System shown in a close-up view as well as in a classroom may be also referred to as a response system. In a system like this each individual in the group responds to stimuli, and progress may be followed by the instructor. How painstakingly do we as teachers identify our objectives? What abilities and insights do we seek to develop? Teaching machines that analyze responses of large groups may enable teachers to work more speedily in helping youngsters identify and overcome their roadblocks to learning. Note that the Eastman Carousel projector is shown here as a visual panel presenter and that tape would present the audio component in the system. In such a system as this, buttons are pushed to indicate choices, decisions, predictions, and evaluations. Pencil and paper, reference study, and physical activity are other components in the instructional design. (Courtesy EDEX Teaching Systems, Palo Alto, Calif.)

as they progress through their mastery of concepts and skills in programed texts or other teaching machines.

As with their use of all instructional media teachers need to select and evaluate programed learning sequences in the light of valid teaching objectives, their instructional quality, and the unique characteristics of a given group of learners. However, such a pat answer may prove to be an oversimplification. Actually, teachers would not want to select for wide use a programed sequence with whole-course, part-course, or even teaching-unit scope until or unless evidence were available about its preparation and trial use with groups having the stated characteristics. Fortunately, publishers of programed sequences for use in machines or as programed textbooks greatly stress the providing of information such as the conditions under which the data were obtained, achievement attained by pupils, and the time needed by students to complete the programs.

INSTRUCTIONAL KITS

The combination of the teaching machine, instructional kit, and other technological media is influencing a trend toward a more complete and self-contained instructional package. This means that the teacher's role will simply be that of an implementor, not a designer or creator of the system insofar as the kit itself is concerned. However, teachers will have to employ creativity in the motivational and pupil productivity aspects of the teaching situation, and will have to decide how best to fit the package and its system into the stream of activity of the entire course. In all cases where instructional kits are utilized, efficient handling and scheduling of materials, the operation of equipment, and the appropriate organization of pupils in carrying out the recommended or required activity will be a major responsibility.

Readers are referred to Chapter 4, to Case Study Number 6, where excerpts from a self-instruction system for teaching a unit in eighth-grade social studies will show some of the major operational characteristics of what was called the *Learn by Yourself Kit*. There the kit was self-contained and made use of direct teaching tapes and individual filmstrip viewers with work sheets for noting responses together with a programed textbook.

AUDIOVISUAL MEDIA IN COMBINATION

Special physical problems are encountered when teachers plan to use several different media during any given class period. Projectors easily get in the way and block the view of students. To solve this problem teachers need to keep slide, filmstrip, and motion picture projectors at the rear of the room on mobile projection stands. Usually, however, this is impossible



Figure 5-26. This instructional kit consisting of film-text-tape materials is titled *Je Parle Français*. Kits like these call for systematic teaching. When kits like these are used, the objectives, for the achievement of which the unit was designed, need to be recognized by the teacher, and supported in other components of activity in and out of school. Only when such kits are designed for this purpose will they permit optimum flexibility in adapting their contents and processes to local needs. (Courtesy Encyclopaedia Britannica Films, Inc., Wilmette, Ill.)

where 2-inch by 2-inch slides are to be used because the normal slide projector lens will more than fill the screen. Hence teachers should get help from audiovisual consultants or dealers in recommending lenses of correct focal length for the specific projectors to be used. Overhead projectors have to be near the front of the room anyway, and here the only problem is to prevent blocking students' vision. A low projection stand 16 inches in height is often the answer. Making an aisle in the center of the room is another possibility, as then the projectors may be arranged down the aisle at appropriate distances from the screen.

Teachers need to plan such multiple projection activities in their rooms and call for the help of extra projectionists if needed.

Two automatic systems for presenting a number of media in combination have been devised. One of these is television whereby film clips, slides, models, photographic enlargements, and real things, may be presented in any sequence as needed by electronic control devices. The other is an arrangement of automated still and motion picture projectors that project their images of sequentially arranged materials upon the push-button command of the teacher by means of rear-screen projection. In most schools the purse strings have been far too tightly drawn to permit the



Figure 5-27. In this picture a presentation is underway in the *Multimedia Instructional Laboratory*. The overhead projector is being used as a separate unit in conjunction with a three-part rear-projection screen. Automatic remote-control projectors are under control of the professor at the special podium. Note also the need for a microphone. (Courtesy Multimedia Laboratory, University of Wisconsin, Madison, Wis.)

use of these latest developments in our audiovisual technology, but a new day in education may well be coming.

THE VOICE AMPLIFICATION PROCESS

The use of microphones in large classes demands special facilities such as the yoke microphone that frees a lecturer's hands and allows him to turn to write or sketch on the chalkboard. Wherever loudspeakers are in the same room with the lecturer, lapel and necklace microphones may not be satisfactory since the high-volume level that is necessary generally produces feedback (squeal from the loudspeakers, or a ringing sound accompanying speech). In television studios, for example, microphone volume may be turned up extremely high because no public address loudspeakers are present. Generally, instructors should stay close to the mike at all times, never turning away from it. Yoke mikes permit close-to-mouth

positioning and hence lower volume settings suffice. They are therefore recommended.

Problem-Solving Activities

1. Using the information and criteria presented in Chapter 3 as well as in *Problem 17* at the end of that chapter, state two good field-trip problems for one of your future classes. Then state in outline form how you would analyze the problems for work by the class and where you would take the class on the trip. In addition to the crucial process of collecting information to solve the problems what trip details would you have to

Figure 5-28. In this view is shown a teacher at Wayland High School instructing a class of a hundred students in typewriting. The teacher's demonstration of keyboard operations can be easily followed by everyone in the room. The teacher is using a microphone mounted on what is called a Shepherd's Crook. The mike is hidden by the lens of the overhead projector. When teachers are necessarily seated at projectors and looking downward at transparencies, their voices cannot be projected effectively toward the class. Microphones may then be as necessary for good communication as are large readable letters on the transparency. (Courtesy Wayland Public Schools, Wayland, Mass.)



- plan? Why is having a problem base the easiest and best professional method for conducting a field trip?
2. What precautions should teachers take to make sure that they are legally protected from possible field trip accidents and fatalities?
 3. Explain how a teacher's objectives determine what is said and done when using models, objects, and apparatus.
 4. What operational procedures will you seek to carry out when giving a demonstration? List five or six examples of demonstrations in your future classes that you could arrange for pupils themselves to prepare and present?
 5. What templates should you make from masonite for repetitive use on the chalkboard in your future classes? Draw five different "stick" figures illustrating unique characteristics usable in your teaching field.
 6. Select an appropriate symbol or diagram in a periodical that you could use if it were enlarged in chart form. Then arrange to project the small figure onto a piece of chart paper or newsprint with an opaque projector for tracing purposes. Apply color and labels and exhibit your work in class.
 7. Choose a filmstrip consistent with your objectives and then select a few good frames from the many to use in your planned presentation. Formulate some questions to use in connection with the frames you have selected. (See also *Problem 11* at the end of Chapter 4.)
 8. What is the basic operational idea underlying the so-called language laboratories? How can regular language laboratory procedures be applied to other subjects? Equipment? Instructor's special materials? What determines the nature of the materials and the related procedures?
 9. According to the operational procedures presented, list five topics for "direct teaching" tapes for use with future classes. Write a sample tape script and a portion of an accompanying pupil work sheet for written responses for any one of your topics. If time permits write another script. Assume you will have all needed instruments, and that the tape will be used by half the class at a time while you work with the other half.
 10. Next time you preview a motion picture, look for two or three film clips, 50 to 100 feet in length (two and one-half minutes each) that would be extremely valuable in your field to illustrate key processes or provide content for special observation.
 11. State several physical variations of running off a film in class (i.e., running off a film a few minutes at a time with discussion of points in between segments).
 12. Identify one of your teachers who recently presented transparencies on an overhead projector. Did he sit down or stand at the side of his projector? Was the projector on a low stand? Was the view blocked for some of the pupils? If the projector were on a high stand could the teacher place the transparencies in the projector and then walk away to the side of the room? Why is this not a good procedure? Did you observe a tilted screen? If not, was the distortion by keystoning critically undesirable?

13. You have a display of numbered study prints (also called flat pictures) on a wall space at eye level. You have a class of thirty pupils and you have handed out a ditto sheet containing ten thought-type questions, one for each picture. How can you arrange during class for pupils to observe the pictures to make their observations without wasting time by standing in line or waiting at their desks? Could you also exhibit the pictures somewhere else for after class viewing? Where?
14. Can you think of a regular television network program for home viewing that you could make use of in your own teaching plans? Name it. What problems or questions would you set up for pupils to answer or solve as an outgrowth of the viewing?
15. Suppose that in the space of a classroom period you plan to tune in a required direct instruction television program from the local school system studio, and then conduct a discussion of three related problems using ten frames of a related filmstrip, and two overhead transparencies. What plans should you make for accurate timing? Should you make a schedule of activity for yourself? Is this kind of pacing necessary for your own good? Will it benefit or harm your pupils?
16. Why is it preferable to stand close to a microphone and have less volume turned on than be farther away and turn on maximum volume. Answer this question in the light of "feedback."
17. Participate as a member of the cast or production crew in preparing and producing an actual television program.
18. If the booklets are available for this purpose, in sufficient quantity, work through the programmed texts titled, *Programed Primer on Programing*, Vol. I and Vol. II, prepared and published by the Center for Programed Learning, New York, N.Y. Write your answer on another sheet of paper to preserve the original booklets for use by other students. When you have finished assess your understanding of the process and how you gained it. Now identify any objective in your teaching field requiring a small segment of subject matter or some special directions for its accomplishment by your future pupils and prepare a short programed learning sequence in the same format calling for specific student responses in small steps. (See Case Study Number 6, Chapter 4.) How would you arrange for a class of your future pupils to work on such a program as you have constructed? That is, how to motivate pupils to work on the program? How will you fit it into other regular teaching procedures?

Available Technological Materials for Class Use

And No Bells Ring. 16mm motion picture. NEA (Dept. of SS Principals). B & W. 57 min. (in two parts). (Use to explain new ways of using talents of teachers and ways of helping students to help themselves. Emphasize contributions of technology.)

- Behind the Tape: The Teacher.* Tape. Minnesota Mining and Manufacturing Co. 30 min. (7.5 IPS). (Use to identify and explain teacher practices characteristic of this medium.)
- Chalk and Chalkboards.* 16mm motion picture. Bailey Films. Color. 15 min. (Use as a means of studying specific teaching practices.)
- Chalkboard Utilization.* 16mm motion picture. McGraw-Hill. B & W. 14 min. (Use to identify specific practices characteristic of the medium.)
- Charts for Creative Learning.* 16mm motion picture. Bailey Films. Color. 10 min. (Use as a basis for identifying specific teaching practices characteristic of the medium.)
- Children Learn from Filmstrips.* 16mm motion picture. McGraw-Hill (National Film Board of Canada). B & W or color. 16 min. (Use to explore specific teaching practices, and to find evidence that the five basic principles were applied in the situations depicted.)
- Demonstration Tape for Elementary Schools.* Tape. Minnesota Mining and Manufacturing Co. 15 min. (7.5 IPS). (Use to provide various examples of uses by teachers.)
- Demonstration Tape for Secondary Schools.* Tape. Minnesota Mining and Manufacturing Co. 15 min. (7.5 IPS). (Use to provide examples of various uses by teachers.)
- Example of a Teaching Machine Program.* Filmstrip, 71 frames, color. Basic Skill Films. (Use as a means of having the class work through the example, frame by frame.)
- Field Trip.* 16mm motion picture. Virginia Department of Education. Color. 10 min. (Use as a basis for analyzing the relationship of definite pupil problem-solving activity to the trip.)
- Film and You (Using the Classroom Film).* 16mm motion picture. B & W or color. Bailey Films. 13 min. (To find teaching practices characteristic of the film medium.)
- First the Ear.* Tape. Minnesota Mining and Manufacturing Co. 30 min. (7.5 IPS). (Use to develop insight into language laboratory operations.)
- Globes: Their Function in the Classroom.* 16mm motion picture. Bailey Films. Color. 14 min. (Use to identify the kinds of globes and characteristics of their use at different age levels. Emphasize using globes as a source of information for solving pupil problems.)
- How to Use Classroom Films.* 16mm motion picture. McGraw-Hill. B & W or color. 15 min. (To find teaching practices characteristic of the film medium.)
- Improving Use of the Chalkboard.* Filmstrip, 44 frames, color. Ohio State University. (Use as a basis for identifying specific teaching practices.)
- Making Field Trips Effective.* Filmstrip, 46 frames, B & W. Wayne State University. (Use to identify teaching practices.)
- The Opaque Projector.* Filmstrip, 42 frames, color. Ohio State University. (Use to identify teaching practices and uses.)
- The School Journey.* Filmstrip, 48 frames, color. Basic Skill Films. (Use to identify specific teaching practices.)
- The Second Classroom.* 16mm motion picture. NEA (DAVI). B & W. 28 min.

(Use to explore television as a teaching medium and to determine teaching practices characteristic of the medium.)

Study Pictures and Learning. Filmstrip, 58 frames, color. The Ohio State University, Bureau of Research and Service. (Use to evaluate teaching procedures shown and as a basis for preparing special teaching plans involving this medium.)

Tachistoscopic Teaching Technique. Filmstrip, 51 frames, B & W. Learning Thru Seeing, Box 368, Sunland, California. (Use to show basic steps in the short-exposure process.)

Teaching by Television. Filmstrip, 51 frames, color. Basic Skill Films. (Use as a means of explaining specific practices characteristic of the medium, and to evaluate the nature of the objectives being taught in the teaching situations shown.)

Teaching Machines. Filmstrip, 64 frames, color. Basic Skill Films. (Use to provide basic information about programmed learning sequences and other teaching machines. Emphasize characteristics of the medium.)

Teaching Machines and Programmed Learning. 16mm motion picture, NEA. B & W. 30 min. (Use as a basis for exploring specific teaching practices characteristic of the medium.)

Teaching with Still Pictures. Filmstrip, 53 frames, color. Basic Skill Films. (Use to identify good teaching practices and the general application of the five basic principles.)

Television in Education. 16mm motion picture. Bell Telephone. Color. 30 min. (Use to identify teaching practices in the receiving classroom.)

Using Graphs and Charts in Teaching. Filmstrip, 51 frames, color. Basic Skill Films. (Use to explore the medium and to identify teaching practices. Clarify the specific ways the five principles for all materials are applied.)

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6

PREPARING SIMPLE MATERIALS

Mature teachers may find that the only way to procure the teaching materials urgently needed to achieve their objectives in their special instructional situations is to make them. In some instances, where technological service centers in schools have been highly developed, they need only make decisions as to what concepts and processes need to be visualized. They may then proceed to consult with production technicians, stating the desirable characteristics for the films, slides, charts, or transparencies required for their purposes. Production crews, such as staff artists and visualizers, even especially talented and trained students, then prepare the materials promptly and deliver them to the teacher. Fortunate indeed is the instructor who has such local services at his disposal. Less fortunate teachers, who nevertheless have the necessary equipment and supplies on hand, may, through their own ingenuity and interest, and by following reasonably simple directions, become successful producers. The following pages suggest possibilities for such action.

Motion Picture Segments

Specialized motion pictures are generally expensive to produce. A standard optical sound track alone for a 400-foot reel may cost two to three hundred dollars. However, an enterprising instructor with a 16mm camera may shoot a 100-foot film segment of an important process or an installation for approximately eight dollars. And if a magnetic motion picture projector is available, or if the school owns a single-system sound 8mm motion picture camera, a sound track may be added that will preserve and standardize significant instructional commentary. Teachers should remember that a 20-minute motion picture subject, as desirable as it sometimes is, may not serve as effectively as a how-to-do-it film segment. The cause of local river erosion or the method for planing a board may be effectively analyzed by an easy-to-make 100-foot film sequence. Television programs, both educational and commercial, have certainly revealed the value of short film sequences to show a "clip" of pertinent action, and modern classrooms are no exception.

Teachers who are going to make their own film sequences need to jot down in advance just what needs to be shown to clarify any given problem. They should be liberal with close-up shots for providing significant details. When others do the shooting upon request, conferences need to be held for a clear understanding of needs, or detailed written descriptions should be prepared and supplied to the photographer for getting the footage desired.

For those who are interested we now discuss a number of vital aspects of the film production process.



Figure 6-1. This biology teacher is discussing the specifications for a set of transparencies with a staff artist at the audiovisual instructional materials center. (Courtesy Penfield Central Schools, Penfield, N.Y.)

WRITING THE FILM STORY

The main problem here is to make up an outline of the story that the film segment will tell. Start with major headings and then fill in minor points to make the action complete.

The film story will then be converted into a list of scenes. Each *scene* is a part of the main topic and is shot with the camera in one place. For example, a *camping scene*: There might be a scene of people around a picnic table, another scene of a glass of water being poured from a jug, or a scene of boiling water to make it safe. The plan for shooting scenes, complete with information for actors and cameraman, is called the *shooting script*.

The better the planning the better the finished film segment will be. Shooting scripts are rough notes to detailed itemized accounts of desired action for every shot of the camera. The nature of the film shots and how they are put together determine the effectiveness and the artistic effect of the portrayal. Therefore the producer who writes a good shooting script should and does get rewarded in good quality, providing, of course, he remembered to take the cap off the lens. The following is one way to organize the content of a script.



Figure 6-2. In some metropolitan learning resource centers where preparation facilities are well developed, there are different kinds of working spaces and tools, and specialized staff members carry out the program. In these pictures we see chart-making, picture-mounting, and device-construction activities in progress. (Courtesy San Diego City Schools, San Diego, Calif.)

Scene No.	Type	Length	Light	Location	Action
Scene 1 Picnic table and 4 people	MS	4 ft.	Daylight	East Park	People eating in joyful mood
Scene 2 Glass of water in girl's hand	CU	2 ft.	Daylight	Same	Lifts glass to drink

A *Close-up Shot* (CU) is a scene with the camera ten feet or less from the subject. A *Medium Shot* (MS) is a scene where the camera is up to twenty feet away, and a *Long Shot* (LS) is a scene where the camera is more than twenty feet away from the subject.

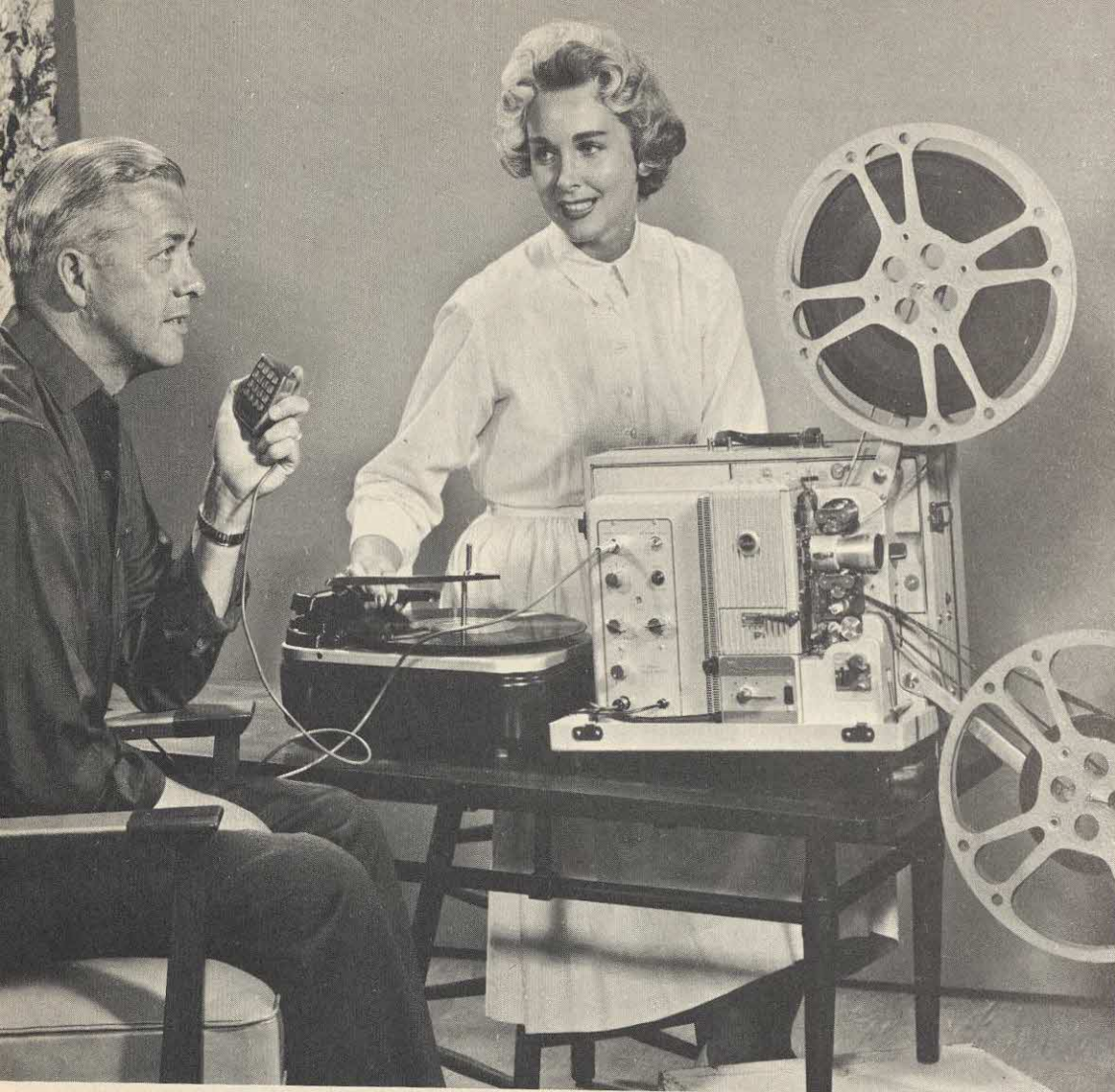


Figure 6-3. A magnetic sound track may be "painted" on film footage by highly developed technical processes. Here voice and music are being mixed and recorded by using a magnetic sound motion picture projector which plays as well as records the sound. (Courtesy Eastman Kodak Company, Rochester, N.Y.)

SOME HELPFUL HINTS ON FILMING

Creative filming is a complex ability, and the process is not dealt with fully in these pages. However, there are a few elementary practices that are basic, and a few of these are stated here to help teachers begin their own productions or help them guide students in special filming projects. Here then are some helpful hints:

1. Use a tripod indoors and out. Steadiness of the projected image later will be your reward.

Figure 6-4. This is a single-system sound camera for taking 8mm sound-on-film motion pictures. The sound is directly recorded in the camera on a magnetic track. Similar cameras for taking 16mm film scenes are also available. (Courtesy Fairchild Camera and Instrument Corporation, Plainview, N.Y.)



2. When a scene has to be interrupted and then resumed, do one of the following: (a) take a cut-away shot of another related object or process before resuming the action, or (b) move the camera in close or move it back to a considerably different view of the action. The rule is to never resume the same scene immediately once the action has been stopped.
3. Keep the camera in one place, focused on one area, and then arrange for the action to take place in that field. The rule is to not pan the camera.
4. Shoot film (even for later silent projection) at 24 frames per second and project it at the same speed.
5. Get action in your scenes.
6. Strive to arrange good continuity in terms of teaching objectives. That is, show clearly what the process is, but strive also to use the revealing power of the camera to go in close or to emphasize the objects or key processes. Do not continue every single process all the way through. Use cut-away scenes and resume an interrupted action at the end point, thus saving time and eliminating boredom. This is not true for complex operations where completeness may be necessary. For example, it would be good to stop after showing a scene of trimming one edge of a picture with a paper cutter, then, after a cut-away scene, show the cutting of the final edge. The other edges would of course have been trimmed off in preparation for the last scene. Some complicated process on the other hand may have to be repeated in entirety, especially when different operations occur.
7. *Key light* is the term used to refer to the main light on the subject or object, and *fill light* is light used to light up the background of a scene. The rule is to have *fill light* weaker than the key light, three to four

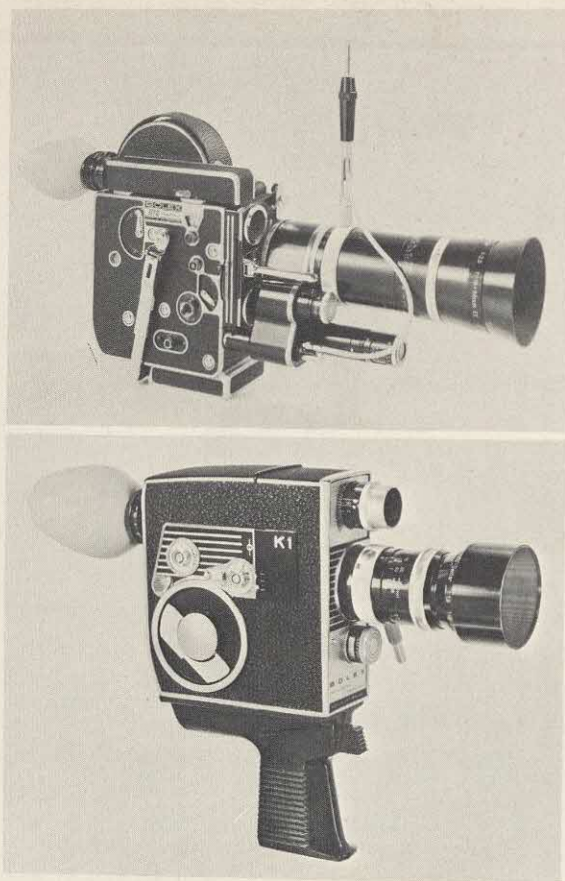


Figure 6-5. Many schools have one or more motion picture cameras available for making sequences for both instructional and public relations purposes. Of course the use of such equipment for analyzing athletic contest action has been common for decades. With the development and expansion of closed-circuit television facilities operated by the school system, the use of motion picture camera equipment for programing has become essential. The Bolex cameras shown are both equipped with zoom lenses. One is for 16mm, the other for 8mm film. (Courtesy Pailard Incorporated, Linden, N.J.)

times on the average, to provide depth effects. Special effects of course need unique decisions.

FILM SPEED IN THE CAMERA

It is important to gauge the length of each scene and this judgment can be easily made if a few facts are known. When a motion picture is to have a sound track added, the scenes must be shot at a speed of 24 frames per second, or 36 feet per minute for 16mm film stock. Scenes should be long enough so that the action will be complete, and long enough so that necessary words in the narration can be added; however, the picture must be short enough to hold the interest of the viewer. If a strip of 16mm film is 9 feet long, it will run for $\frac{9}{36}$ of 60 seconds, or 15 seconds. If it is 3 feet long, it will run for $\frac{3}{36}$ of 60 seconds or 5 seconds. One foot of film will run for about $1\frac{1}{2}$ seconds. It should be remembered that shooting 8mm film stock at the rate of 24 frames per second is the equivalent of 18 feet per minute. Therefore a scene 9 feet in length would not take 15 seconds as with 16mm film, but rather 30 seconds.

Figure 6-6. Motion picture filming with inexpensive equipment becomes a challenging problem-solving activity for youngsters in junior and senior high school. See also Chapter 1 and 3. This is a group of gifted sixth graders at work making their own film as a class project. (Courtesy Eastman Kodak Company, Rochester, N.Y.)



SOUND

Since the film production suggested here is the film segment, titles, music, and narration may not be called for, but when magnetic sound projectors are to be used commentary may be easily added. Here is some briefly stated advice. The commentary needs to be brief and interesting, and needs to fit the purpose and action of the film. Usually only two words can be spoken in one second, hence for a scene that is 3 feet long (5 seconds running time), about 10 words of commentary can be spoken. Pacing is extremely important.

Figure 6-7. Key piece of equipment in the editing process is a film viewer. Shown is an inexpensive sturdy Moviscop Film Viewer-Editor. The film travel is from left to right. Simple geared rewind devices may be obtained as a part of this equipment being mounted on a single-mount board. On this machine the scenes of the original film footage are viewed and cut apart and taped together with masking tape in proper order. After final checking of the length of scenes by a final viewing, they are spliced together on a regular film splicer. (Courtesy Harwald Company, Inc., Chicago, Ill.)



Opaque Projector Material and Mounted Pictures for Display

Teachers who are continuously searching for significant visual materials often find diagrams, charts, and photographic illustrations in magazines that may be cut out and taped to mounting stock for use in an opaque projector. Opaque projectors do not as a rule project images that are as sharp as desired, and when rooms cannot be adequately darkened this method is quite unsatisfactory. Moreover, fine print accompanying graphic illustrations is almost never readable in the projected image by viewers seated in back rows.

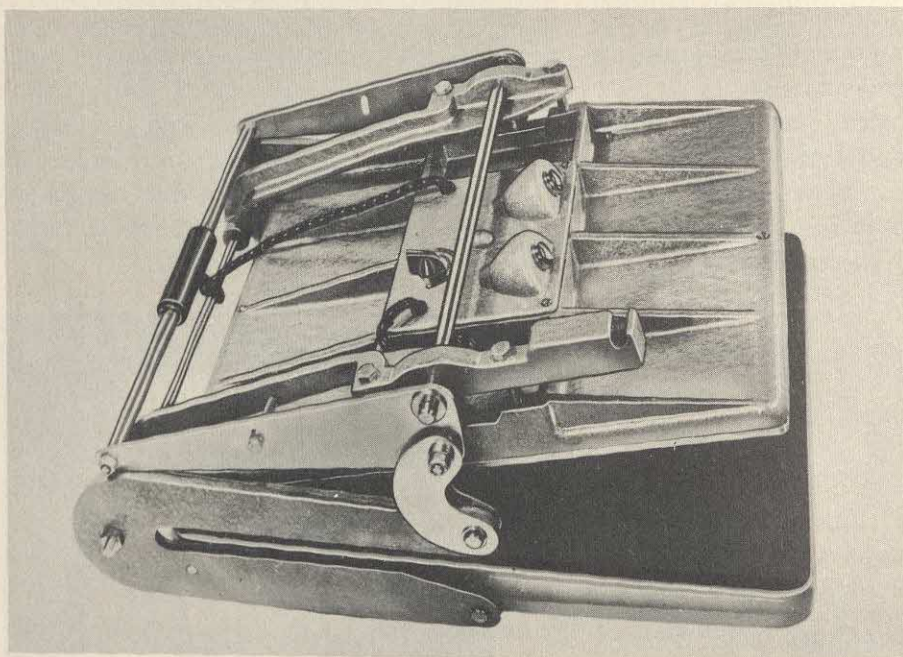


Figure 6-8. Pictorial materials that are to be preserved for repetitive use should be mounted on suitable heavy-stock paper or laminated between plastic sheets. Both processes may be carried out on a dry-mount press as shown. Dry-mount paper, larger than the given picture or item, is tacked on by a tacking iron, then trimmed by a paper cutter or scissors (if the item such as a figure or letter is to be cut out), positioned on the mount board, tacked down to keep it in the proper location, then placed in the press for five seconds at about 225 degrees. Any picture or newspaper clipping may be laminated by enfolding it with a thin transparent Mylar product called Sealamin, by covering it completely, top and bottom, with newsprint or construction paper, and inserting this assembly into the dry-mount press for about twenty seconds at 270 degrees. Photographs generally require 325 degrees and a prior emulsion-hardening alcohol bath using a ball of cotton. After alcohol treatment the photograph should be left to dry thoroughly. (Courtesy Seal, Inc., Shelton, Conn.)

Opaque projectors are especially valuable, as has already been stressed, in enlarging diagrams and small charts for display purposes.

Pictorial and graphic materials of value in any given course may be preserved effectively and displayed with greater impact when they are mounted on suitable mounting surfaces by dry-press methods, using dry-mount tissue; or, if the press is unavailable, by the rubber cement process. Such materials, mounted or not, may be displayed by fastening them to bulletin boards, taping them to wall surfaces, or suspending them by small clips from wire. Whenever a dry-mount press is available, teachers may wish to use the simple process of laminating pictures, clippings, etc., between thin pastic sheets.

As has been pointed out earlier, the way such pictures fit into lecture, demonstration, observation, and assignment procedures determines the worthwhileness of the effort involved. At any rate, if materials are to be made at all, the first job of the teacher is to locate or create the graphic content and then to prepare it for projection or display.

Bulletin Board Displays

The logic of creating good displays may be simply and tersely stated under three main phases of teacher action.

THE HEADLINE

Decide first on the headline, the essence of the message to be conveyed. This headline should grow out of the teacher's purposes, namely, the understandings, abilities, attitudes, and appreciations. When pupils and teachers create the headline for displays in the school corridor or in store windows downtown, they themselves in like manner decide on the headline that will change behavior in the target audience they have identified. However, the pupils are in this case intensely involved in the very objectives that the teacher has in mind, so they tend to learn what they wish to achieve in others.

Headlines need to be dynamic. This can be achieved by putting the verb first. Here are some examples:

Put Yourself in the U.N.
Be Helpful Today
Listen!
Communicate Clearly



Read this Meter
 Live Safely Today
 Solve that Problem!
 Observe Accurately
 Seek the Facts
 Prevent Fire!

Make the headline visible with bold colorful lettering, and if you get stuck, or if it is difficult, put the headline in *question form*, or make a terse declarative statement like:

A Misplaced Decimal Can Kill (Drug dosage)
 Fire Prevention Is Your Business
 Honesty Is The Best Policy

Without a valid headline an array of pictures becomes at best a visible picture file. With the headline the teacher may move with confidence in guiding youngsters to learn to communicate, to challenge them to think, to be creative, and to search for illustrative content that will involve the viewer. Dynamic headlines call for a high level of involvement, and they are performance oriented. The teacher who never puts verbs first in display headlines may have fallen into the trap of teaching subject matter to the exclusion of performance. Headlines should not be just a topic; they should be the crux of a message.

ILLUSTRATING THE HEADLINE

The next aspect of basic display logic is to use illustrations, both abstract and realistic, to make the meaning of the headline clear. Problem-solving activity, moving parts, confetti ribbons, objects, dials, pictures, and diagrams all need to be chosen to elicit audience curiosity and maintain the grasp until the message has been comprehended. With the headline in mind, the choice of illustration narrows, decisions can be made, and even young display makers can be challenged to reach new heights of critical judgment and creativity. Alas! When the teacher lacks knowledge of these simple display construction principles, leadership and guidance are lacking and pupil creativity falls short of accomplishment.

ARRANGING THE ILLUSTRATIVE MATERIALS

There is no limit to creativity with the logic of display technique. But once the good headline is on paper or on the bulletin board, and the

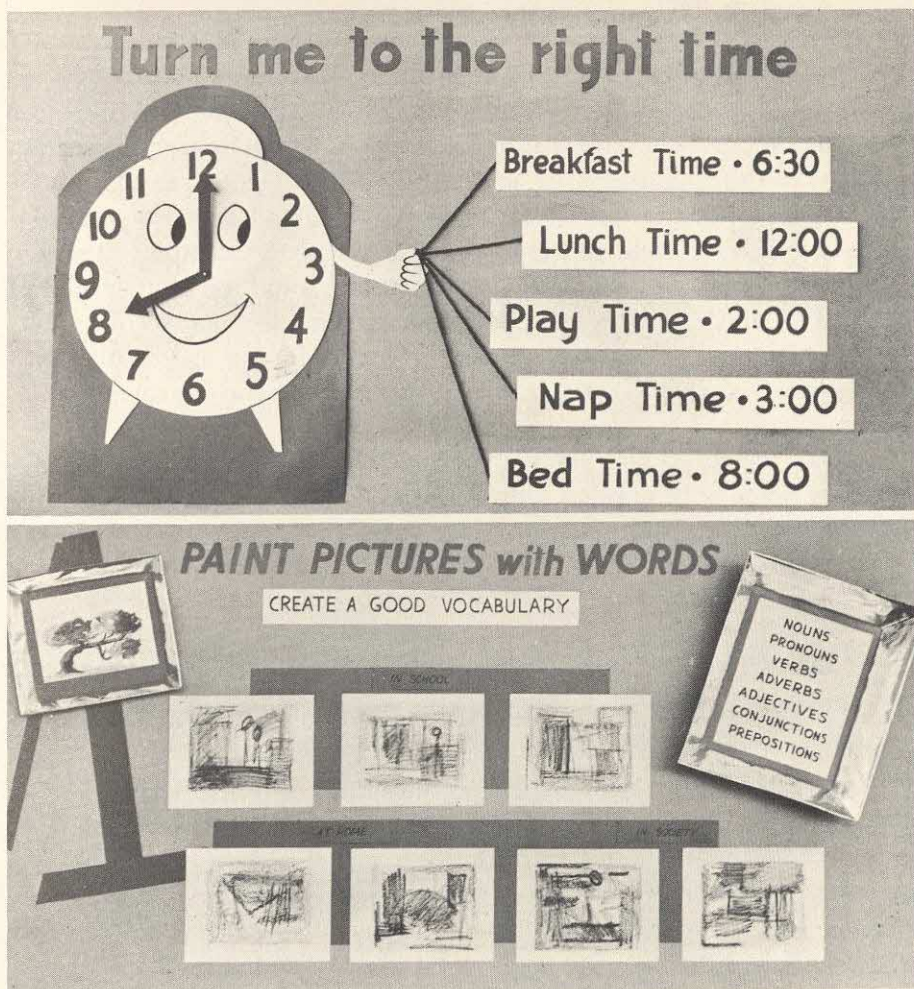


Figure 6-9. These displays illustrate the basic aspects of good bulletin board construction. First, a good headline guides the learner to desirable responses. Does the headline in the first display start with a verb? Does the second display headline also start with a verb? Do these headlines possess a dynamic character? Do figures and symbols illustrate the headline in each case? Check the nature of balance and arrangement of materials. (Courtesy Thomas A. Koskey, Baited Bulletin Boards, Fearon Publishers, 828 Valencia, San Francisco, Calif.)

illustrations are at hand, then the job remains to arrange the materials effectively. This calls for good balance of an informal, contrasting kind, plus emphasis, unity, good judgment, and good taste.

Using Color. Wise selection and deliberate use of color will make headlines and illustrative materials more visible, will emphasize and attract attention, and will add a dimension of reality to diagrams, drawings, and other materials. Letters for headlines are frequently cut out of colored paper and placed against a sharply contrasting background, or two sets of letters are cut out of different colors of paper and overlapped for special effects. Display backgrounds may be enhanced by colored paper or textured

materials, and colored paper as a background for a specific diagram or picture in a harmonious relationship provides emphasis and increases impact of the material. In addition to seeking greater impact of displays by using contrasting colors, it is generally advisable to select realistic colors for the illustrations chosen. Green leaves and grass, brown soil, blue sky and water, and red tomatoes will suffice as examples. Another good rule to follow is to avoid the use of too much and too many different colors. Too much color may appear strident and too many colors may create confusion. An excessive number of colors in any one display may be ineffective when serving to distinguish processes and/or categories of objects.

All that has been said about the use of color in connection with displays also needs to be applied when creating posters, flannel boards, three-dimension exhibits, slides, and transparencies.

Instructional Tapes with Classroom Equipment

It has already been pointed out that pupils and teachers work together to produce taped dramatizations, interviews, and discussions as significant learning activities, but teachers also produce their own instructional tapes, some of which may be direct teaching or self-contained teaching tapes. Whatever the nature of the recording job and regardless of whether the recordists are teachers or pupils, stress should be placed on achieving quality. Since the audio program medium was discussed in Chapter 2, the operational features of using tapes in the classroom discussed in Chapter 5, and since the mechanical process of running a tape recorder is emphasized in the next chapter, we shall offer here some important procedures for preparing and presenting the content, and for the use of microphones in a number of recording situations.

Pupils who are listening and responding to taped presentations deserve optimum production quality. Many times they do not get it because of excessive noise on the tape, lack of enunciation in the teacher's voice, material being presented too speedily or even too slowly, and because the arrangement of content is defective. Let us turn first to suggestions about content.

Preparation and Presentation of Content. Teachers who prepare instructional tapes will be much more successful when they proceed as suggested below:

1. Identify and be critical of their specific teaching objectives before selecting and arranging content.
2. Develop a feeling of readiness in the pupil at the beginning of the

tape by introducing the specific topic, explaining the process, or raising a few questions.

3. Decide what the pupil responses need to be to fulfill objectives. Should response be whispered, written, figured mathematically, checked on a map, and so on?
4. Decide how long the presentation needs to be, making sure not to exceed attention and concentration capabilities of pupils, which ranges from ten to thirty minutes, or longer, depending on maturity, motive, and nature of content.
5. Decide about the pacing of explanations and questions by working through them from a pupil's standpoint, and, if feasible, have several pupils work through the responses before recording the presentation.
6. Write out the script, word for word, so that timing may be improved, revisions made more easily at a later date, and evaluation by other teachers and colleagues may be facilitated.
7. Use language that makes your tape a person-to-person message.
8. Make use of musical excerpts, sound effects, and other audio "clips" of pupils and adults to maintain interest. Remember each pupil with his headset on is your pupil and you are communicating with *him*.
9. Prepare pupil response sheets to accompany the script.
10. Make the best possible recording on the equipment available.

Microphoning Procedures and General Conditions. Everyone understands *eyestrain*, but, by judging from the poor quality of some instructional tapes used uncritically by teachers, "earstrain" has not been thought about. Effortless listening by the pupil is a condition that we strive to obtain when viewing a motion picture or a television program. One aspect of effortless listening is optimum volume and the other is distraction or conflict because of improper balance in various sounds or because of noise. Noise is recorded together with other desired sounds

Figure 6-10. This teacher is preparing an instructional tape recording under favorable conditions. Extraneous sound is minimized by using the Trifold Acoustical Portable Sound Booth. Such acoustic tile folding panels may be fabricated locally and distributed to the school building media service center for use by teachers in their own classrooms. (Courtesy Board of Education, Norwalk, Conn.)



unless it is eliminated or minimized. Here then are the recommended procedures for obtaining quality through good microphoning and the establishment of other general recording conditions:

1. Find a quiet place in which to make your recording—classroom, office, recording booth, or sound studio, and protect yourself and your mike from noise. That is, close windows, turn off motors, and hang up “Quiet please, recording” signs.
2. Use a new tape for critical work, or erase the old tape on a bulk-tape eraser machine, if available.
3. Set up the microphone to make possible a comfortable recording posture and adjust it for a six to ten inch mouth-to-mike distance. Short mouth-to-mike distances make possible lower volume settings with consequent lowering of extraneous noise.
4. Use a high quality microphone if it is available.
5. Do not turn away from the mike while speaking into it.
6. Adjust recording volume and make a test recording. Play back the test recording through your headset, not the regular speaker. Adjust conditions and volume settings as required before going ahead with the final recording process.
7. Arrange for an assistant or a colleague to help with sound effects, musical excerpts, and general adjustments.
8. If conditions are not appropriate, ask to take the tape recorder and microphone home where rugs and drapes may provide better acoustical conditions.

Non-Photographic Slides: 3 1/4-Inch by 4-Inch Size

Because almost every school system has several unused lantern-slide projectors that could probably be procured on a long-term assignment to their classrooms, and because the process is so easy, teachers should explore the possibility of tracing important textbook diagrams and charts on etched glass with soft lead pencil. Special slide-coloring crayons may be used to add color for emphasis. The following basic materials are necessary and should be purchased in bulk: (1) etched glass, 3 1/2-inch by 4-inch, (2) slide crayons, (3) lantern-slide masks with 3-inch by 2.75-inch aperture, (4) clear cover glass, and (5) 1/2-inch or 3/8-inch slide-binding tape. Transparent lantern-slide inks are also available for this purpose.

Simple rules and hints for preparing slides are as follows:

1. Draw on the etched surface only.
2. Always outline the drawing in pencil for good definition.
3. Apply crayon or ink evenly up to the pencilled lines.

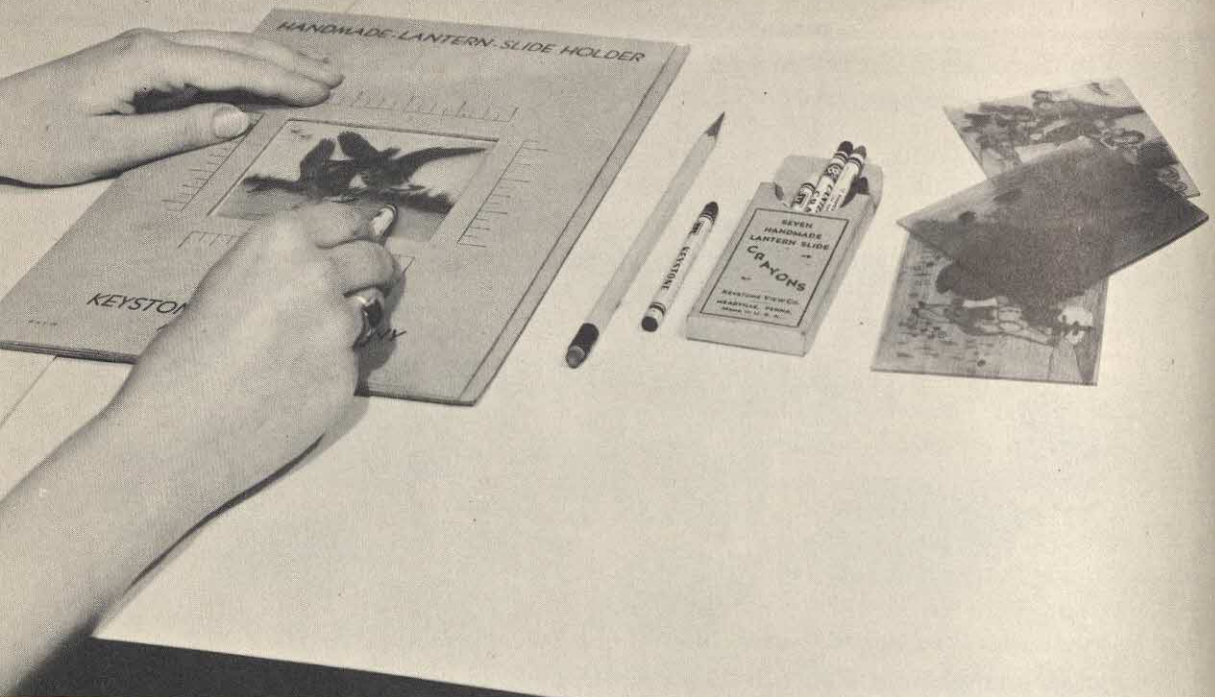


Figure 6-12. Note the simple process illustrated in this picture. Instead of a black mask over the picture, as called for in the first of seven steps given in the step-by-step process, a Keystone Slide Holder is being used. Note the required horizontal position for the picture content. (Courtesy Keystone View Company, Meadville, Pa.)

2. Use soft lead pencil to trace a firm black outline of the drawing on the etched surface. (Or if you wish, make a freehand drawing directly on the glass.)
3. Use crayons to apply color up to the lead-pencil lines. Sharpen crayons as needed by rubbing points on sandpaper.
4. Make colors vivid by firm pressure and reapplication.
5. When drawing is finished, put black mask on top of etched glass and place a piece of clear-cover glass on top of mask. Pick up the assembled pieces as a unit, press together, even up the edges by pressing them down on the table top, and then bind together with binding tape.
6. Bind firmly using a two-inch piece of tape for each edge of the slide. (This is the quick simple way to protect your drawing. Other methods like the *passe partout* or slide-wise method should be used when time permits.)
7. Put a small piece ($\frac{1}{4}$ -inch square) of tape on the glass in the lower left-hand corner of your bound slide as it lays on the table, drawing side up. This is the thumb mark. When projecting the slide in a regular slide projector with horizontal carrier, rotate your slide so this mark is in the upper right-hand corner. Grasp the slide at the thumb mark

and insert it in *just that position in the slide-projector carrier as you face the screen.*

A $3\frac{1}{4}$ -inch by 4-inch lantern-slide projector at the rear of the room on its own projection stand, available for intermittent use during any given class period, would be a tremendous timesaver, and would be as indispensable for the elementary teacher as for the art appreciation instructor, or for the chemistry teacher.

Three-Minute Polaroid Lantern Slides: $3\frac{1}{2}$ -Inch by 4-Inch Size

Polaroid 46L film develops a positive image on clear film instead of paper. This film may then be mounted in a plastic snap-together frame for immediate projection. This process is of instructional value because it takes three minutes or less to copy diagrams and other graphic illustrations from a wide variety of sources. The simple steps in the process are shown in the illustrations, Figure 6-12.

The Polaroid Copier outfit, costing approximately \$250, is necessary for doing this valuable work. Such outfits are generally available, or should be, in the technological service center of every school.

The unprotected Polaroid slide surface is sometimes subjected to a certain amount of buckling, because of the effect of heat during projection, and, for effective preservation, Polaroid slide transparencies ($3\frac{1}{4}$ -inch by 4-inch) may be placed with a lantern-slide mask between two clear cover glasses and bound together with slide-binding tape. While such slides are slightly thicker than most slides, they will nevertheless fit the usual $3\frac{1}{4}$ -inch $\times$ 4-inch slide carriers.

While the Polaroid slide-making process is excellent for copying diagrams as well as photographs from periodicals and books, it is also valuable in converting *lay-outs* and *paste-ups*, made by the teacher, to $3\frac{1}{4}$ -inch by 4-inch slide form for projection. Such processes are described in greater detail in the section dealing with 2-inch by 2-inch slides, but attention should be given to the following specific suggestions:

1. If using capital letters on a typewriter, try for a maximum size of 4-inches by $5\frac{7}{8}$ -inches. Use new, black ribbons.
2. If using larger letters (Leroy lettering device, instant type, hand-printed, large-type typewriter) originals may be planned to 11-inch by 14-inch. Larger charts than this may be photographed by tacking to a bulletin board and mounting the Polaroid camera on a tripod. The parallax difficulty will enter into this process, but it may be corrected by proper positioning of the camera, on the second trial.

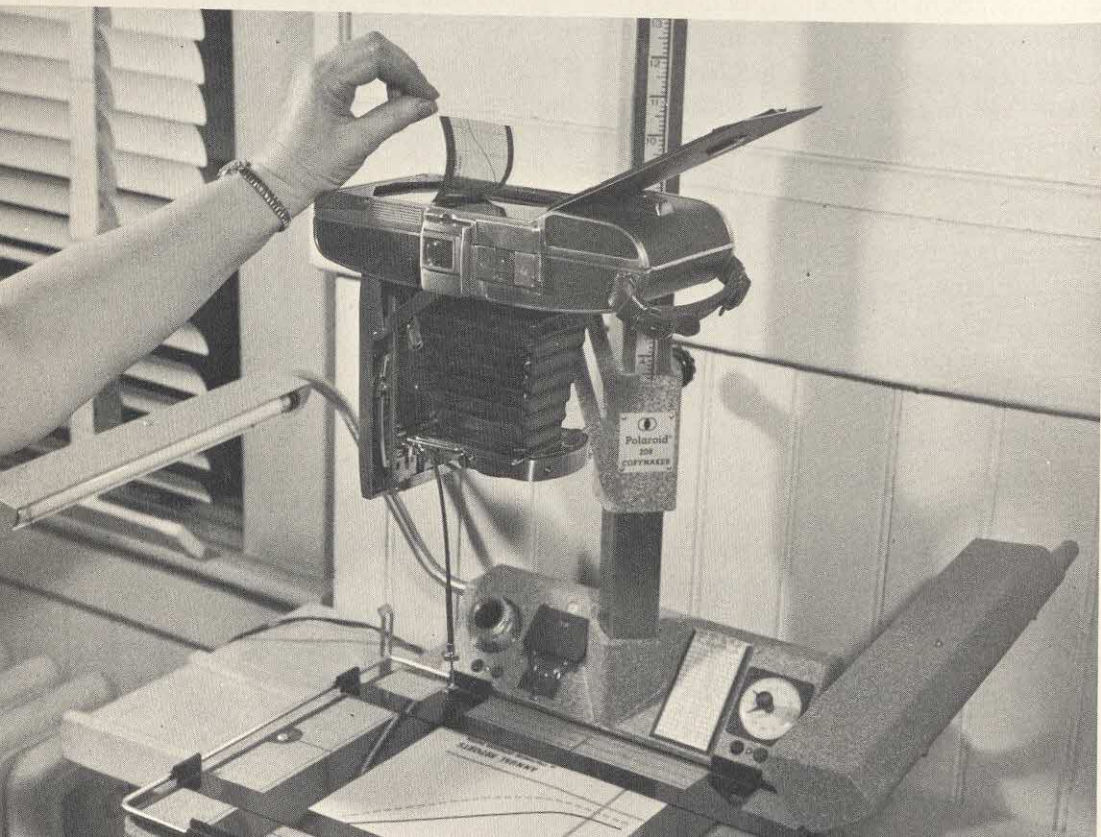
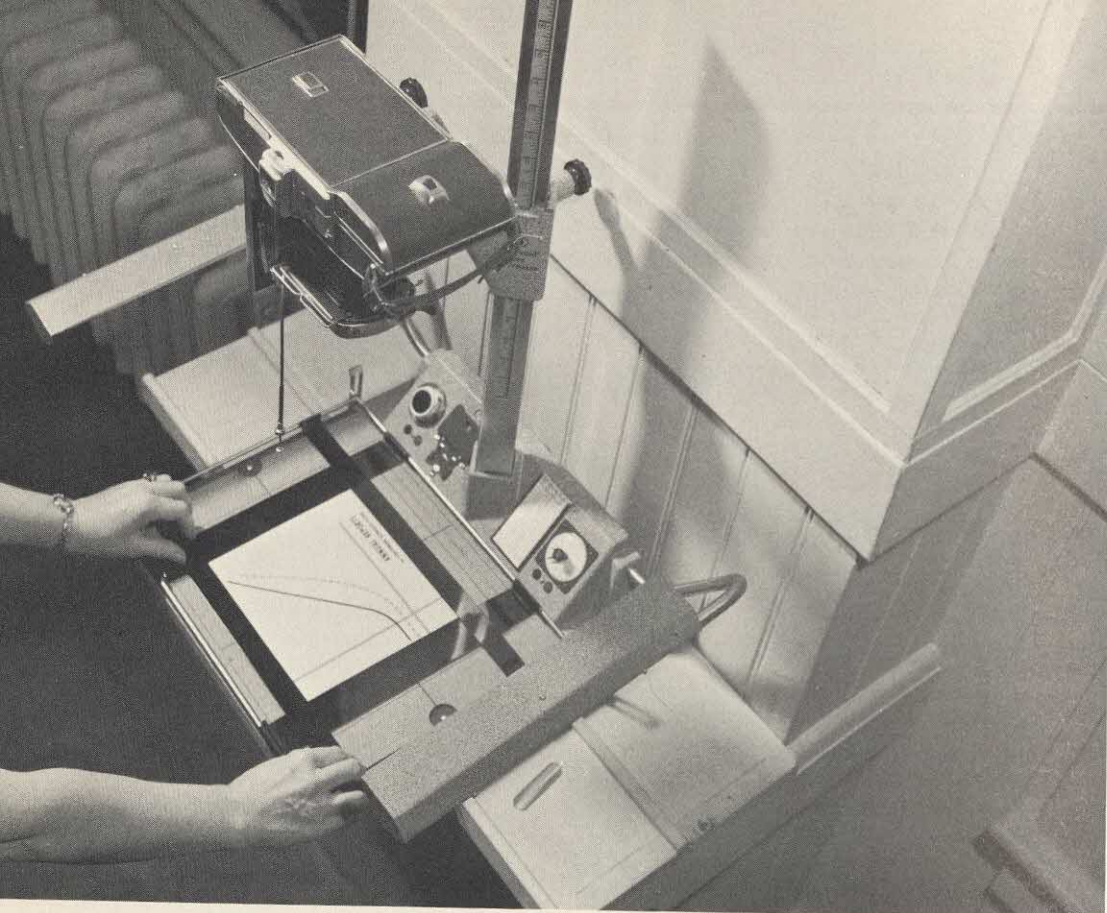


Figure 6-13. Shown in these pictures is the Polaroid 208 Copymaker. The teacher carries out a series of simple operations using this camera and stand as follows:

- A. In the top picture she positions the picture, graph, sketch, postcard, etc., within one of the numbered rectangles clearly marked on the base.
- B. Refers to this number on the small data card just to the right of the bottom of the post and gets all the settings needed for the particular rectangle being used. She thus selects the designated close-up lens, and presses it over the regular lens, raises or lowers the camera to the specified height on the scale, visible on the post, focuses the camera by turning the focusing knob to a predetermined figure stated on the data card, cocks the shutter, sets the lens opening lever at about $f32$, turns the exposure speed ring to $\frac{1}{2}$ second for the type of material shown in the picture, and takes the picture.
- C. She then pulls out the Polaroid film according to regular camera procedures and sets the black reference indicator on the timer to the point on the dial where the red sweep hand was when the film was pulled out into the developing position. She now waits two minutes for the 46L film to develop.
- D. The teacher next opens up the back of the camera as shown in the bottom picture, and taking hold of the corner of the film, tears it out along the perforations, being sure not to damage the soft emulsion on the underside of the film.
- E. In the next picture the teacher hardens the emulsion by inserting the film (holding it by the tab) through the slot in the top of the Dippit container, closes the lid, turns the container upside down and agitates the liquid by shaking the container gently for fifteen seconds, after which she grasps the film tab protruding through the top of the container and withdraws the film through the tightly closed slot, thus removing the liquid. The teacher now lets the film dry for two or three minutes.
- F. In the next picture the teacher lays the film into one of the two plastic mounting frames designed to receive the film between the raised guides, matching the cut corner of the film to the only corner of the frame that is of double thickness. The matching plastic frame is then pressed down on the film and firmly snapped into place.

The slide is now ready for projection. Note in the last picture how the slide is placed into the slide carrier of a regular $3\frac{1}{4}$ -inch by 4-inch slide projector. Slides are always inserted upside down and the appropriate thumb marks are already stamped into the plastic frame to facilitate this action. In this connection care must be taken to insert the film between the frames as recommended. If the picture was not photographed upside down, use scissors to cut off the corner of the film diagonally opposite the corner already cut, and match this new edge to the filled-in corner mentioned above. (Courtesy Polaroid Corporation, Cambridge, Mass.)

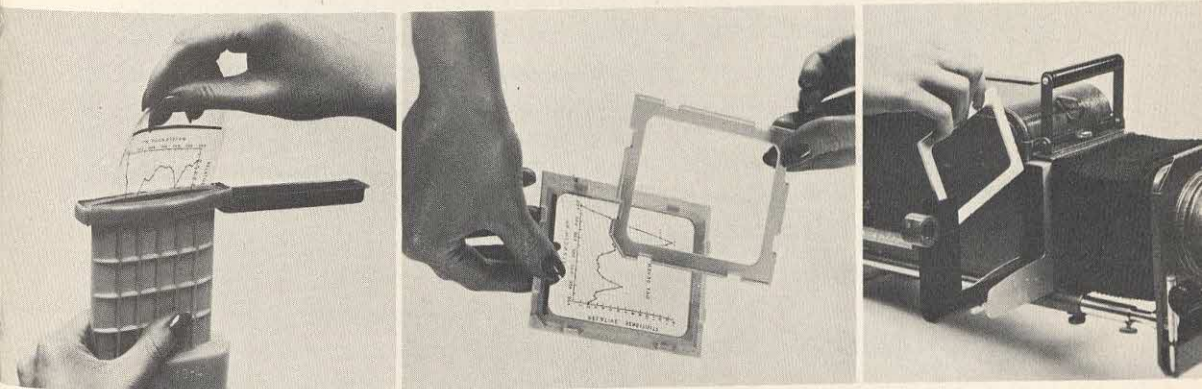




Figure 6-14. In this view the slide-binding tape has been wrapped around the edge of the two pieces of glass held together in the vise. The tape is being cut. The next step is to slit each corner with the scissors and then fold the tape over the edge and smooth it down against the glass. Another method is to cut a strip of tape just barely long enough to reach from corner to corner and then press it down along the edge, one edge at a time. (Photograph by David H. Curl, The University of Connecticut, Storrs, Conn.)

3. Use black ink and make dense lines, figures, and letters.
4. Break up masses of data into smaller units when possible.
5. Use horizontal aspect only for arranging data. That is, a vertically oriented diagram on an $8\frac{1}{2}$ -inch by 11-inch sheet should be constructed in the center of the page along the $8\frac{1}{2}$ -inch axis. The finished $3\frac{1}{4}$ -inch by 4-inch slides are projected in the horizontal position only.
6. Use small originals when the audience is to be large.
7. Use the cut and paste-up technique on a white sheet base.

As will be pointed out later, the Polaroid slide process has other applications in the production of overhead transparencies that are approximately 8-inches by 10-inches.

The 2-Inch by 2-Inch Slide

Teachers who are contemplating the purchase of a 2-inch by 2-inch camera for hobby use would be well advised to select a single-lens reflex

model. There are many available at various prices. Whether or not close-up lenses are available, and whether or not the viewfinder is accurate with any given lens combination in use, should be taken into consideration when deciding what brand to purchase. While any 2-inch by 2-inch camera may be used for copying, the single-lens reflex model permits the photographer to view the exact area (insist on this accuracy) that is being included in the picture. In other words the usual difficulty with the parallax problem is avoided, and for extreme close-up work when copying diagrams, color illustrations, small charts, etc., this is an essential advantage.

Teachers do not have to be expert photographers to produce regular color slides for classroom purposes. The proper equipment, however, needs to be properly set up for convenient action, and, once teachers familiarize themselves with the standard conditions of lights, framing, and exposure time for general slide-making photography, results will be amazingly good. Prepaid processing mailers speed the return of rolls of color film to the teacher in paper-mount slide form.

Many instructors are totally unaware of the ease with which complicated diagrams can be reproduced for reports and class explanations with the single-lens reflex camera. Even copying stands and lights are unnecessary if the books and papers to be copied are taken outside and photographed in the sunlight.

Standard color film stock is satisfactory for even black and white sources, giving sharp definition often comparable to work with regular black and white film. For outdoor work all that is needed is a special slip-on, or screw-on, lens for close-up work. Larger charts and graphs in color photograph well at distances as small as three feet with standard lenses. However printed matter in this case is almost never large enough to be read in the projected image. Thus new larger lettering on labels may have to be added to large charts and diagrams before photographing them.

When indoor photo work is being done, lights on simple stands may be used to illuminate charts taped or tacked to vertical surfaces. A tripod is needed for exposures longer than one-fiftieth of a second. Regular copier-stand equipment for indoor use makes possible speedy work of excellent quality. The audiovisual service center in every school should have such equipment in suitable work areas for instructors to use by appointment; or such centers may even provide slide-making services free of charge by using student work crews.

When preparing slides for teaching purposes, instructors should consider the need for slides in sequence, interspersing diagrams with pictorial illustrations, for example. Other times they might show a long shot or overview of a scene before showing a close-up view of one object. In effect a "shooting" plan for the sequence of slides is the counterpart of a motion picture script. Such planning will do much to facilitate the accomplishment of desired learning results.

A few specific examples of the kinds of operations teachers need to be able to carry out will reveal the possibilities. First, let us turn to the simplest job, copying a picture out of a magazine or book.

COPYING A PICTURE OR DIAGRAM OUT OF A MAGAZINE OR BOOK

When assuming that the teacher is working with copying stand and fixtures to hold the camera, and assuming further that it is loaded with indoor-type film, or daylight-type film with the proper blue filter, and is in a rigid horizontal position, here are the procedures:

1. Lay the magazine picture on the table directly under the camera, right side up or upside down (makes no difference, since the finished slide may be projected vertically or horizontally.) For a book, the problem is to get the book to lie flat. Two or three 6-inch lengths of a wooden slat may be placed under one part of a book to even it up, and careful use of masking tape to hold down the pages at the edge may help to keep the picture in a level position while photographing it. Adjust the lights on the stand, or clamp light fixtures to a nearby chair, to illuminate the surface of the picture evenly and without the objectionable "hot spots" of reflection.
2. Estimate, or consult a field-size chart, and select the close-up lens needed for the size picture to be copied. Affix it to the camera and, by looking through the viewfinder, adjust camera height above the picture for sharp focus and framing, moving the picture and/or the camera height as needed for best results.
3. Read the photo light meter, if one is built into the camera, or get a meter reading if the meter is separate, and make proper speed and lens-opening settings.
4. Shoot the picture.
5. Change settings if you wish to take an additional picture or two to make sure of getting a good exposure. In such cases leave the speed setting as it was and take one picture with the lens opened up $\frac{1}{2}$ or 1 whole stop and the next picture with the lens closed down $\frac{1}{2}$ or 1 whole stop.
6. Send the roll of film away for processing in a convenient prepaid self-mailer container and await the return of your 2-inch by 2-inch color slides.

Without the benefit of a standard copying stand, a tripod may be used with the pictures or post-cards being tacked to a bulletin board or taped to a chalkboard. Some teachers prepare a special black paper envelope with

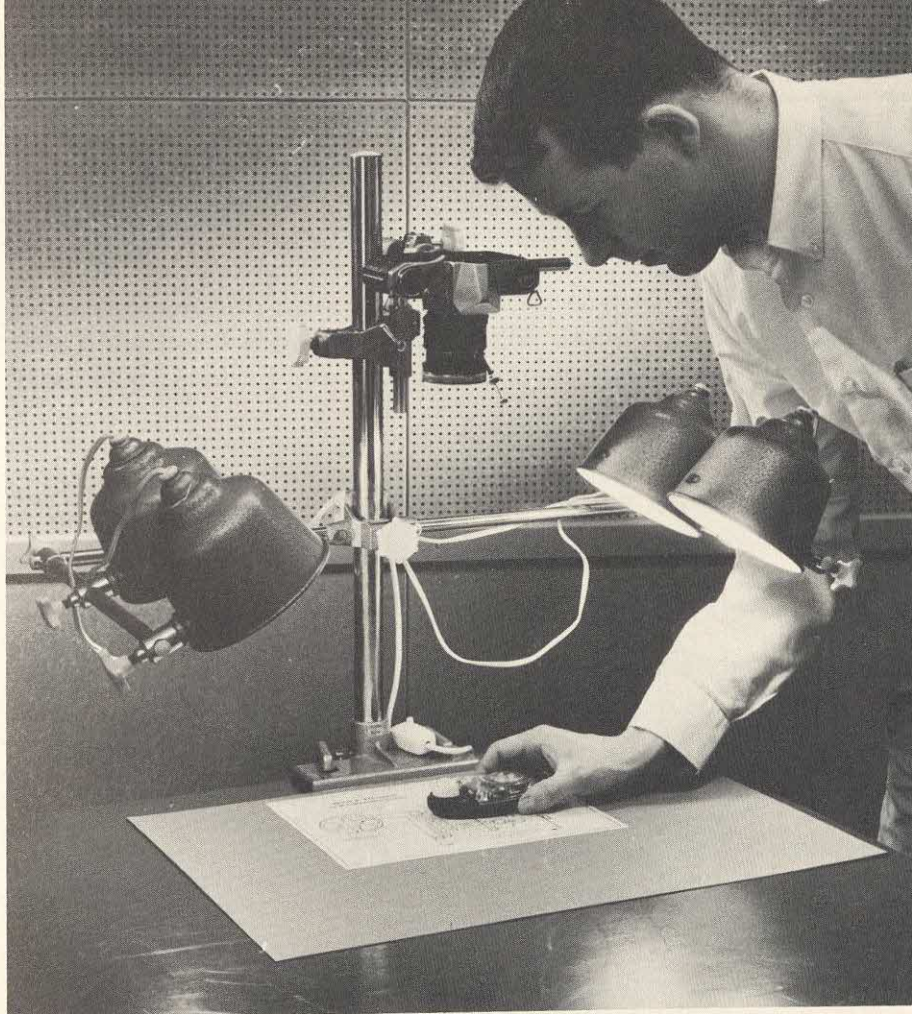


Figure 6-15. This camera stand equipped with lights permits the camera to be moved up and down to obtain good focus and vary the size of the photographic field. It may be clamped to the edge of most school work tables. Compare the arrangement of the camera and the diagrammatic material about to be photographed in this illustration with the step-by-step generalized instructions given. This camera may also be mounted on the clamp of the Polaroid stand shown in Figure 6-13. (Photograph by David H. Curl, *The University of Connecticut, Storrs, Conn.*)

an opening just a little smaller than the postcards to be photographed. Color postcards may be photographed and thus converted into color slides of excellent quality, provided of course that they were properly lighted and the film was correctly exposed. Black paper strips may be used to create a suitable border around a magazine picture, or to hide unwanted parts of the picture and undesirable printed matter. Also, extra labels and/or captions may be added by typing with a primer-size-type typewriter on strips of white or colored paper and affixing them to the picture being copied. A small dab of rubber cement will hold such labels and captions in place when pictures are being photographed in an upright position. Books

will, of course, have to be set on a small shelf at the right height with pages being taped back with masking tape. Care must be taken to avoid mutilation in such instances. Of course, the photographer could make use of a helper to hold the book against a chalkboard or bulletin board.

The 2-inch by 2-inch slide in color or black and white is so convenient to store in well-numbered and coded sets for a given teaching unit and is so easy and inexpensive to make that teachers are urged to learn to use the copy camera expertly for preparing their own vital teaching materials in this form.

THE PREPARATION OF DRAWINGS AND PASTE-UP SHEETS FOR COPYING

Another process ideal for teachers who know how to use a single-lens reflex camera is the preparation of their own drawings, diagrams, graphs, maps, and data tables on colored or white paper, using crayons and other color pencils, marker pens, solid color or patterned tapes, and colored paper cutouts. Such drawings may be made on any size paper stock in postcard size or perhaps as large as the 11-inch by 14-inch size, or larger. In preparing such sheets teachers must be aware of the need to use readable letters and numbers. In preparing such *lay-outs* or *paste-ups* teachers make the following common errors:

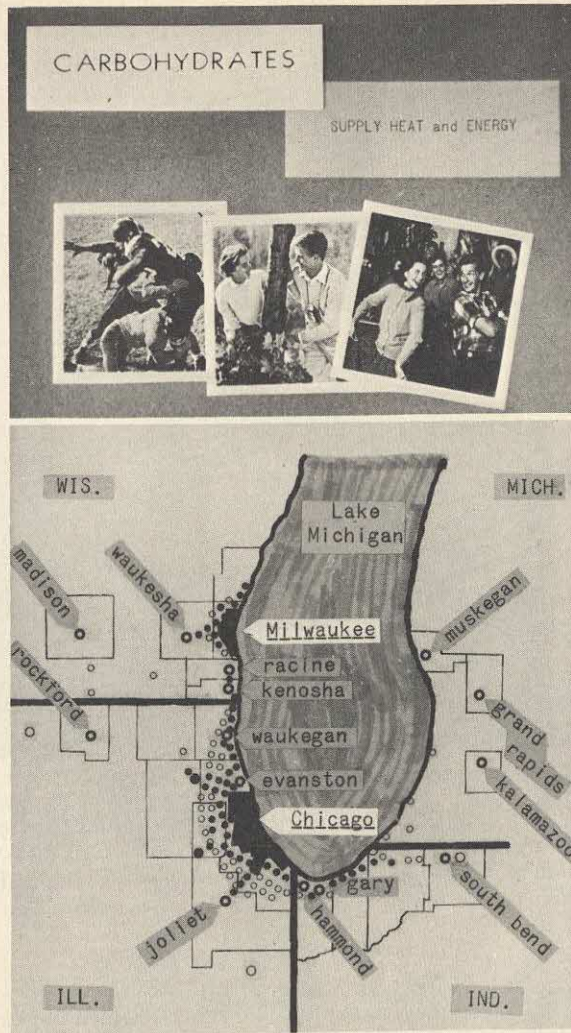
1. Too much material is crowded into a given area to be photographed.
2. Letters and figures are made too small.
3. The sheet to be photographed is too large to be photographed conveniently using regular Polaroid and 2-inch by 2-inch reflex-camera copy-stand procedures.

All three of these failures lead to the same projection weakness, namely, the projected image cannot be read.

Teachers who wish to prepare their own source material for conversion into 2-inch by 2-inch color slides may avoid these errors by heeding the following suggested procedures:

1. Try to confine masses of typewritten data to smaller than 24 square inches, preferably to the 4-inch by 6-inch dimension. When using a regular typewriter try using both black and red letters. Type on colored mimeo paper, or on colored construction paper.
2. When using large letters in labels and captions, figures and diagrams to the 8½-inch by 11-inch size may be satisfactory.
3. Use a typewriter with primer-size type for labels and captions whenever feasible.

Figures 6-16. These pictures represent two colorful slides made by teachers from "paste-ups." The first picture in the group was made from the color slide itself. The three snapshots shown were clipped from a magazine advertisement by the Eastman Kodak Company and grouped under the heading. (Courtesy Louise M. Haire, Teacher, and Eastman Kodak Company, Rochester, N.Y.) The second picture is made from a colorful slide by a political science professor, who made this special purpose map, one of a series, showing step-by-step development of a geographic area. Note the primer-size typewriter labels. (Courtesy Ross Stephens, The University of Connecticut, Storrs, Conn.)



4. Use horizontal or vertical arrangements as demanded by the material. Horizontal arrangements are best, however, for many projection situations. (For example, where screens are mounted too low to accept a vertical slide without interference from shadows of viewers' heads.)
5. Type headings on contrasting light-colored paper, cut into strips, and lay them on the base sheet for special effects. (Black and white originals are also satisfactory with color film.)
6. Use colored pressure sensitive tape and/or crayons for diagrams and charts on a colored paper base.
7. Use dense, broad lines, with ink or crayon.
8. Use Letterguide scribes, reservoir Rapidograph pens, or Instant Type in various colors for lettering.
9. Use new, dense black typewriter ribbons to provide better contrast.



Figure 6-17. This photo darkroom is a part of the learning resource service center in a metropolitan school district. Where a supporting technical staff is still unavailable is it not more economical to pay for commercial photo services and limit the preparation of photographic materials to such media as color slides and Polaroid film procedures that do not require darkroom facilities? (Courtesy San Diego City Schools, San Diego, Calif.)

Many teachers have learned that fifth-grade youngsters can operate copy cameras and light meters, and can handle lighting and photography processes, thus serving as student assistants. Pupils may also incorporate such creative production work in preparing their own assembly programs or class reports. This pupil activity provides the means for developing some unique communication skills and deepens insight about the organization of information to convey meaning clearly.

PHOTO DARKROOM

So far none of the processes described calls for photographic darkroom operations. This is because reversal color film was used, and this film eliminates the intermediate step of having to produce a negative. Sometimes it is more convenient and economical to pay for the services of photofinishers and wait for a few days to have a finished set of slides returned in the mail. It is a fact, however, that many schools, primarily

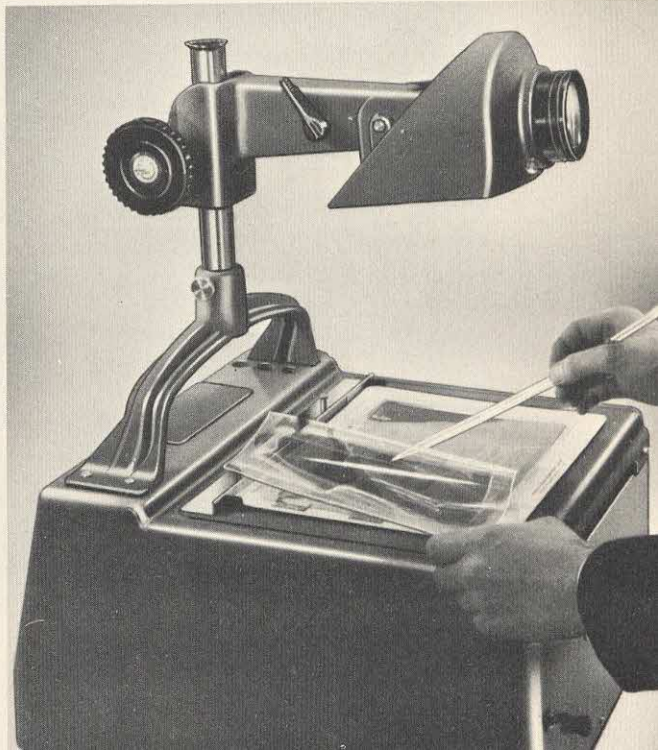
secondary schools, have well-equipped darkrooms. Some of these are located in audiovisual centers and others are in the science suite. When such spaces are available, teachers, especially photohobbyists, may wish to develop photo laboratory skills. However, even the development of black and white negatives and the subsequent printing of photo enlargements may be handled commercially.

Overhead Projector Transparencies

Recent technological developments in overhead projectors and diazo-ammonia transparency processes have opened a new field of graphic materials for instructors. Together with such developments are the photocopier devices, some of which produce direct, clear positives, thus facilitating projection techniques.

One of the most striking projection processes made possible by these diazo-coated film techniques is the overlay or multiple-layer method of projection. By this process it is possible to project a basic image, for example, a simple diagram, and then, as needed, successive layers of transparency are flipped into place, building up or adding to the image development. Maps and diagrams used repeatedly in almost every classroom at every level of instruction are uniquely suited to such overlay-projection techniques, and teachers in any given school or school system might well share in the planning and production of such needed materials.

Figure 6-18. This is a close-up view of the Tecnifax overhead projector and an overlay transparency in position on the projection stage. Note the framing guide that holds the transparency in place. In this instance one overlay sheet remains to be flipped down for presentation. Teachers should not use their hands to flatten down a transparency layer. A transparent pointer should be handy for doing this, as well as to guide attention to portions of the presented content. (Courtesy Tecnifax Corporation, Holyoke, Mass.)



There are several kinds of transparencies for use with the overhead projector, and these are now briefly described to show the range of possibility for classroom applications.

1. *Graphic forms, drawings, and diagrams on clear acetate sheets.* In these transparencies the graphic content is built up by using grease pencils, felt-tip marker pens, acetate ink and pens, and transparent tape and adhesive-backed tint sheets for color. Such clear acetate sheets may also be run off from a ditto master on a regular ditto machine. The finished acetate sheet is then mounted on a cardboard mounting frame. Ready-made graphic symbols, transparent tape, and instant lettering may also be used to advantage in preparing such acetate sheets. Projectors are available in several sizes—for transparencies of about 7-inch and 10-inch widths—but the large size has become the standard size despite increased bulkiness. Several layers of such drawings may be projected in sequence as desired; however, then accurate registration of each successive sheet is essential.
2. *Stylus drawings with other printed or typewritten content on a carbon-coated film base.* These carbon-coated sheets are then mounted on cardboard projection frames and covered with protecting clear acetate sheets. Such diagrams may be colored by transparent inks and by applying colored sheets of thin acetate film. The negative portion of a high quality spirit reflex master sheet may also be sandwiched between two clear acetate sheets, mounted on a cardboard frame and projected effectively. Thus handout sheets may be made and distributed to a class together with verbal instructions and explanations based on a projected image of the same content.
3. *Soft lead pencil and colored slide-crayon drawings of diagrams and charts on etched acetate sheets.* The sizes are 7-inch by 7-inch or 12-inch by 12-inch. They are mounted as previously described. Such acetate sheets are then sprayed with aerosol plastic to make them transparent and to increase brightness and sharpness. The pencil lines and crayon or lantern-slide-ink colors filling spaces up to the pencil lines constitute the same process used with etched glass previously described.
4. *Clear positive transparencies made by photocopy techniques.* Such transparencies made by either wet or dry process equipment are also mounted as previously described for projection.
5. *Transparencies made by shining ultra-violet light through a "master" sheet on which are arranged opaque drawings and other graphic illustrations to expose diazo-coated film.* Subsequent development of the exposed film in ammonia brings out black and white or solid-color images on white or tinted transparent background. The transparency

Figure 6-19. This photograph shows a Leroy® Lettering Scribe being used with a template for symbols. Reservoir pens as shown make possible continuous work on a lettering job without stopping to add ink, drop by drop, as was required by the older pens. (Courtesy Keuffel & Esser Company, Hoboken, N.J.)



Figure 6-20. Materials and devices such as these speed-ball pens, brush pens, ruling pens, templates, stencils, cutout letters, Instant-Type and Foto-Type, take the drudgery out of lettering and make it possible for every teacher to do neat, artistic work. (Photograph by David H. Curl, The University of Connecticut, Storrs, Conn.)



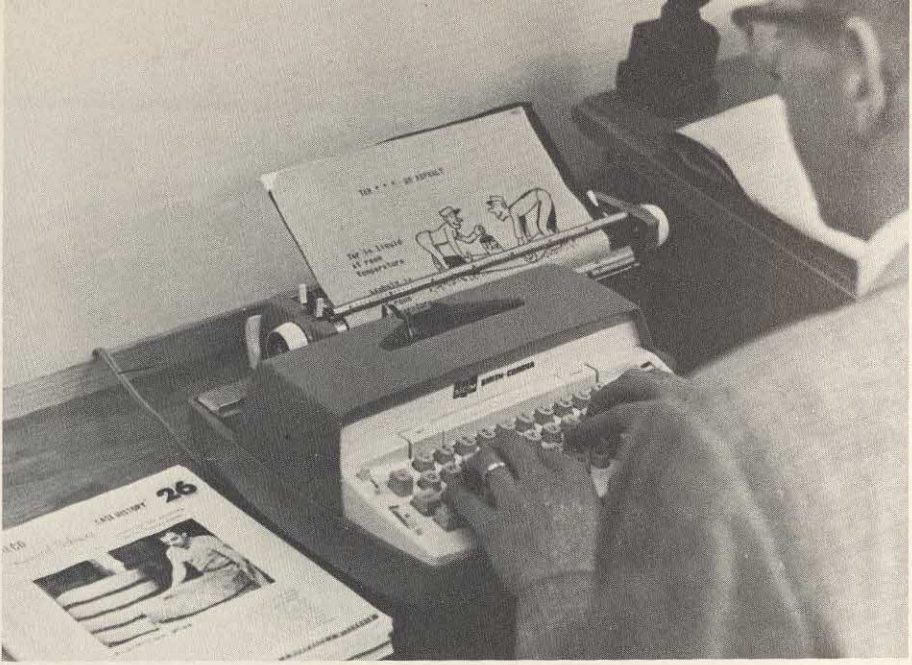


Figure 6-21. This primer-size typewriter types large letters on a master sheet for improved readability during projection. Note the back-up carbon sheet. New black ribbons are needed for best printing results. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

is then mounted for projection. Many kinds of lettering guides and lettering materials are available, including primer-size-type typewriters and the so-called strip-printer machines to speed the work of preparing labels and printed copy.

6. *Transparencies in multiple layers of diazo-type film.* Complex graphic material may be easily constructed in separate layers of acetate with all overlays in accurate register to be projected at the same time or one at a time.
7. *Transparencies made by "lifting" clay-coated black and white and color prints.* Magazine illustrations are the sources generally used for this process. Transparencies so made are sprayed and subsequently mounted on appropriate cardboard frames for projection.

Now let us turn to a number of examples of step-by-step processes for preparing two types of transparencies. First, a simple process to put a line drawing directly onto an acetate sheet.

STEPS FOR THE SIMPLEST HAND-DRAWN OR ARRANGED TRANSPARENCY PROCESS

The simplicity of the hand-prepared transparencies is such that, given a line drawing that does not require too many fine details, shadings, and the like, probably a youngster could follow some simple instructions and

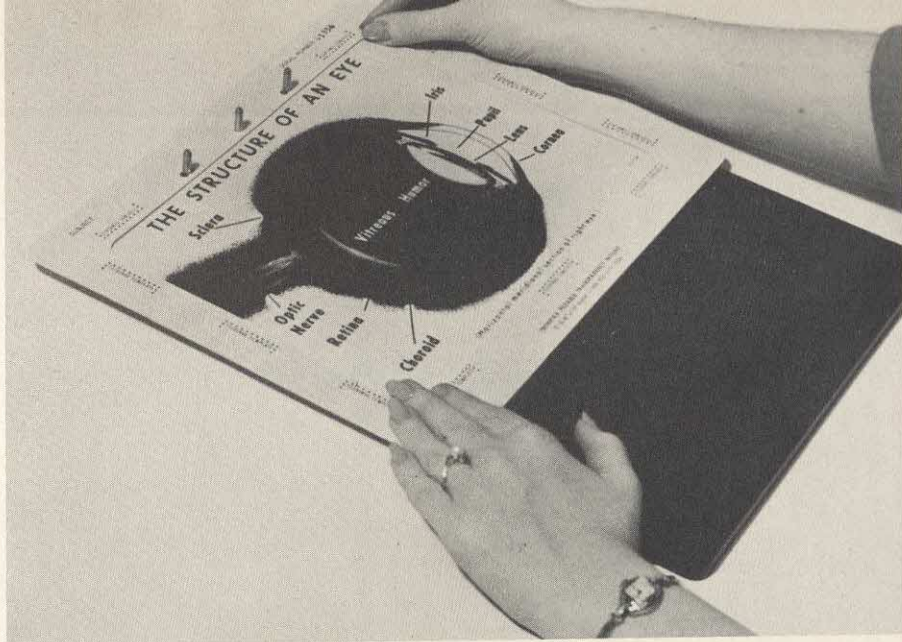


Figure 6-22. Multiple layers may be combined in a single transparency in two ways, either taped down on top of each other, or hinged so that each layer may be flipped down into projection position in any desired order. See also Color Plate 5. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

prepare a very usable transparency. Let us look at such a step-by-step process.

1. Place an 8½-inch by 11-inch acetate sheet over your 7-inch line drawing, centering it in either a horizontal or vertical position.

The drawing to be traced may be a graph, a map, a diagram, or other graphic material.

2. Trace outline of drawing by using grease pencil with firm solid lines. Grease pencils colored black, white, or orange will of course project on the screen as black since all are opaque to light. There are many ways to make your symbols. Cut them out of construction paper and tape them to the acetate, using broad strips of such paper for graphs. Use transparent tapes to one inch in width for direct application since they are adhesive backed. There is an ink made especially for writing on acetate, and also there are lead pencils for this purpose. Blocks of color may be superimposed over parts of the sheet using adhesive-backed plastic sheets in a wide range of colors. Marker pens of the felt-tip sort are also usable.
3. Fasten the single acetate sheet to a cardboard mount frame by using transparent non-bleeding tape (Scotch Tape, No. 810). Put a strip of tape along each edge.
4. More than one layer of acetate may be used, but all sheets used must be kept in accurate register. That is, split your drawing into several

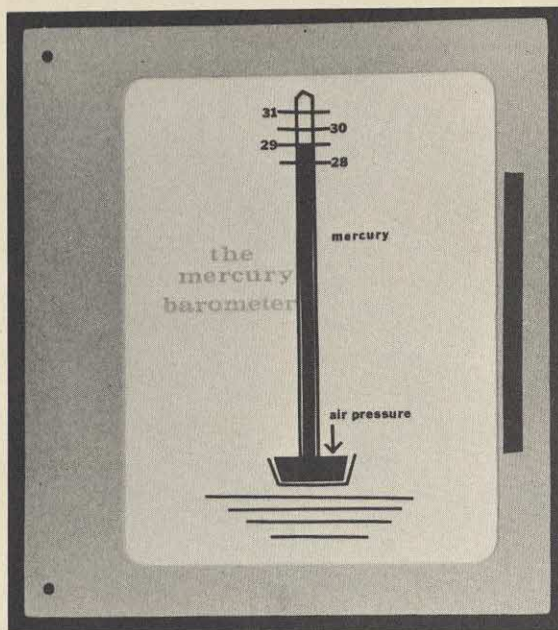


Figure 6-23. Shown here is a black-and-white picture of a colorful transparency made by a teacher from opaque and transparent tape and special lettering materials. The transparency was mounted on an inexpensive cardboard frame. Refer to the appendix. (*Courtesy William Boyle, Teacher, New Britain Public Schools, New Britain, Conn.*)

parts, planning to present one part at a time. Tape down the top sheet on top of the base acetate sheet while drawing on it.

Care should be taken not to superimpose lines and labels on top of each other, and each sheet should be so hinged at one edge that it can be laid down over the acetate sheet on the bottom as desired. Special plastic hinges are available for this purpose.

Other transparencies may be made by using photocopy acetate sheets with either wet or dry development processes. In these cases, drawings, maps, and other graphic materials, including printed matter, may be taken from newspapers and magazines, or from white sheets on which black line drawings have been made in ink or pencil. In these cases the acetate sheets, as soon as they are made (in case of the dry process) or after they have been washed and dried (if wet development processes are used), are taped to the cardboard frames for projection. Undesirable portions of the original may be blocked out by several masking processes, for example, using black, narrow, adhesive-backed tape to fasten down a strip of construction paper.

STEPS FOR MAKING A MULTIPLE- OVERLAY DIAZO-TYPE TRANSPARENCY

A description of the many techniques for making overhead projector transparencies is beyond the scope of this book, but excellent comprehensive references on these processes are available, and such references are

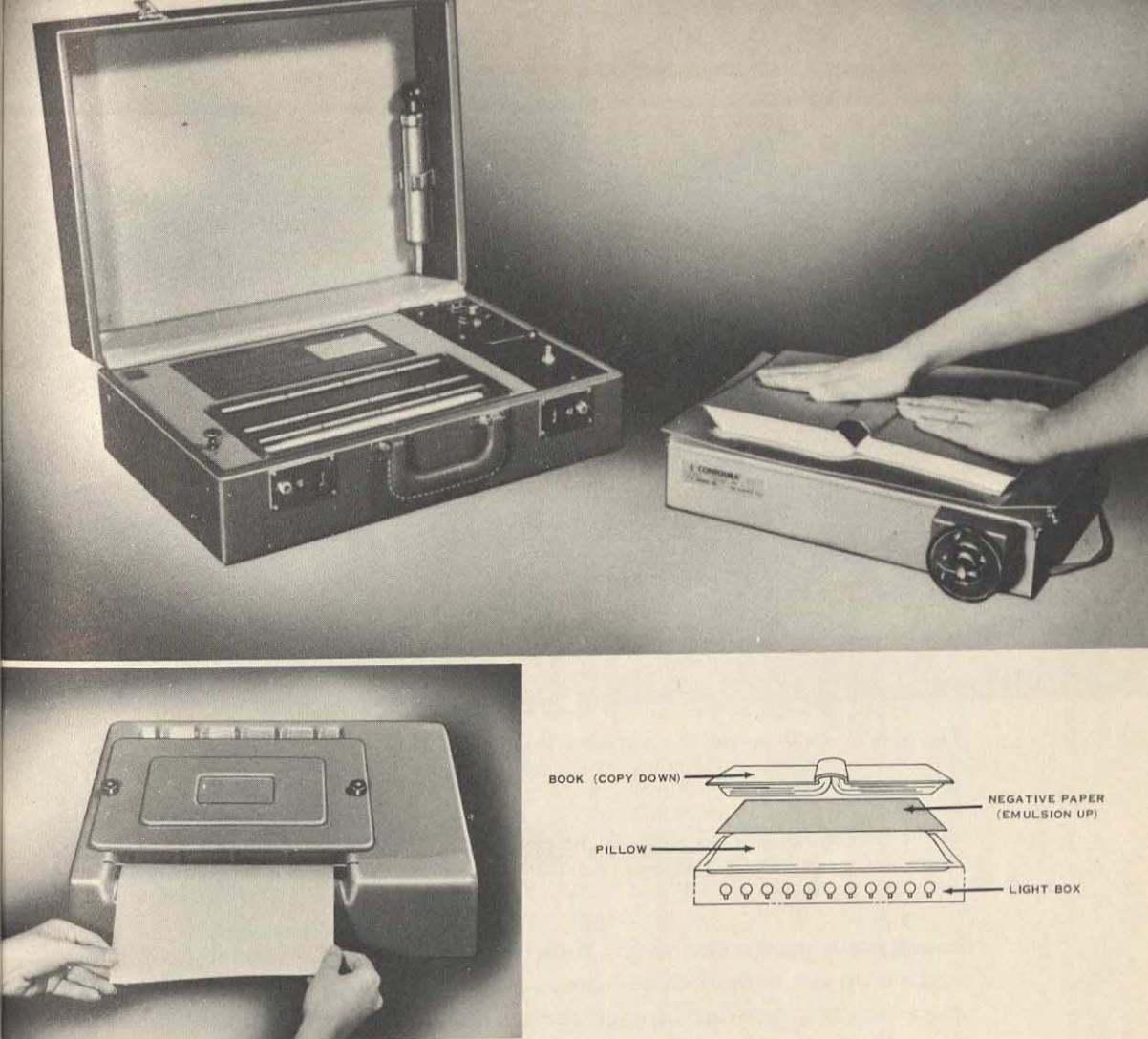


Figure 6-24. This group of pictures shows the simple processes for producing transparencies by using the Contoura wet-process system. In the top picture at the left is the single-sheet exposing and developing unit. At the right is shown the device necessary for exposing a page in a book. Note the timer device. When using the book-exposing device, the negative-sheet image is transferred to positive film by developing both sheets together in a unit as shown in the second picture. The diagram at the right shows the exposing process using negative paper. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

given in the chapter bibliography. At this point and for introductory assignments and projects, the reader need concern himself with only the more commonly used general processes. Therefore in the preceding section transparencies made by direct sketching and coloring were discussed, and now we show how the preparation of one or more *master sheets* (on translucent paper or clear plastic sheets), using black ink or opaque tapes and cutouts, may be printed in various colors and then projected as one



Figure 6-25. In these pictures a teacher is shown printing a transparency of his own drawings by means of a Thermo-Fax dry-process photocopier. He may use this transparency as illustrated in the second picture to lay over students' exercise sheets, drawn in accordance with the specifications of his assignment, and thus in standardized fashion detect inaccuracies in their work. Or he may mount the transparency in a cardboard frame and project it for purposes of explanation or evaluation while students detect their own errors. (Courtesy Visual Products Group, 3M Company, St. Paul, Minn.)

composite transparency or as a projectual in layers. The former is often referred to as a *static* and the latter as a *dynamic* transparency. These processes are made possible through the technological development of diazo-coated film.

We shall now provide directions for the preparation of a *multiple-overlay* transparency showing the steps in stages. *Stage One* gives the steps in preparing a black line, or single color, transparency; *Stage Two* describes the process for employing several colors; and *Stage Three* shows how to use the multiple-layer technique. These step-by-step processes are visualized in the pictures and in the special diagrams in Color Plates 5 and 6.

STAGE ONE: BLACK LINE OR COLOR

1. Choose a *master sheet*, either translucent paper such as the products whose trade names are Tecnivellum and Visi-Tran, or a clear acetate sheet. Using opaque ink, opaque paper, strips, and symbols, or

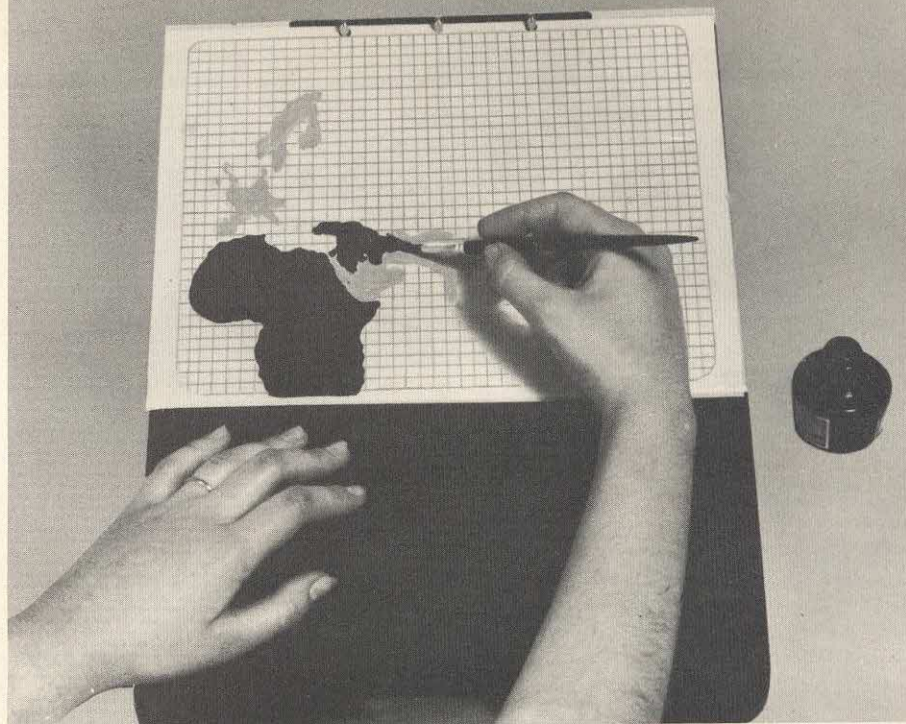


Figure 6-26. This is basically the process of creating an opaque image through which ultra-violet light of the exposing unit will not pass. Inking pens or brushes, paper cutouts, and pressure-sensitive tape are needed. The master sheet may be special tracing paper, or it may be clear acetate in which case the exposure time is reduced. See also Color Plate 5. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

opaque tape and pen or brush, make up the black image on the paper or acetate always using bold, dense lines. Trace a diagram or map in a book, or make a free-hand sketch. In this case let us agree on an outline map of the United States. Letter it as needed using a speed-ball pen, acetate ink pen, brush pen, or use heat-resistant, black, instant-type letters.

2. Prepare to expose the diazo film and make a black print. To do this select a sheet of black diazo film from its package and place it face up on the pressure-assembly or exposing board. Lay the master, drawing side down, against the diazo film, put the glass plate on top of it, and insert this assembly into the exposing machine for the recommended exposing period of approximately three minutes in the small and inexpensive exposing machines.
3. Remove the assembly board from the printer, remove the master, roll up the exposed diazo film, and place it in the ammonia gas container, that is, into a so-called pickle jar or into a diazo printing machine. If the exposure time was correct a dense black image will develop on the clear and colorless background, free of black coloration or black tint in the base stock.

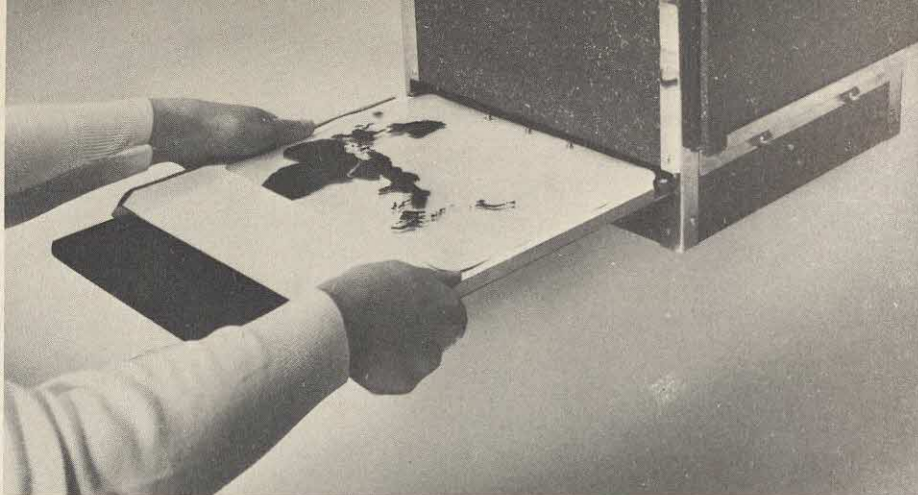


Figure 6-27. Read Step 2 again. What position is required for the master sheet? Is it not supposed to be face down? Is this picture incorrect? Since the master is a paper sheet, the map probably would have been invisible or partially so, hence this incorrect picture. Unless the master is placed face down the resulting image may be slightly fuzzy. After exposure this assembly board is removed from the exposing unit. See also Color Plate 5. (Courtesy Tecnifax Corporation, Holyoke, Mass.)



Figure 6-28. This is the way to insert a rolled up diazo-coated sheet into a "pickle-jar" ammonia developing unit. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

4. Select a cardboard mount frame and tape this first-stage black-line acetate sheet to the top of the frame. Tape all four edges. Use Scotch Tape, No. 810 (Magic Mending Tape). This is a translucent non-bleeding tape. This transparency of an outline map of the United States would now be ready to project. (Note: If an outline map in red had been desired instead of the black as in Step number two the same black master would have been put face down on a sheet of red diazo-coated film.) Step number four ends Stage One.

STAGE TWO: MAKING A STATIC TRANSPARENCY USING SEVERAL COLORS

Let us begin by using the same outline map of the United States as the basis for our illustration, and for comparison with Stage One operations. In Stage One we wanted only a black or red outline map of the United States in a single transparency. Now we desire to have a single trans-



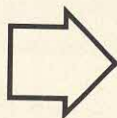
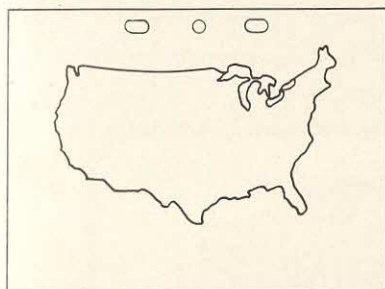
Figure 6-29. This teacher is shown taping a United States outline map to the bottom of the mount frame instead of the top. Very often when several layers are used, the base layer is taped to the bottom of the frame. No. 810 Scotch tape is recommended. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

parency of the same map with the outline in black, and with three different zones indicated by different solid colors, red for the West, yellow for the Central zone, and blue for the Eastern zone. This final product could be achieved as follows:

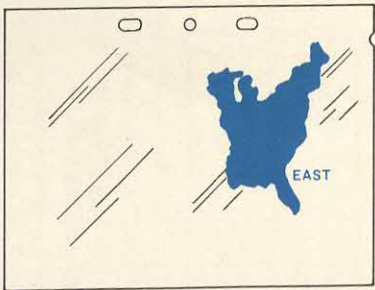
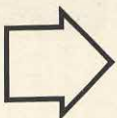
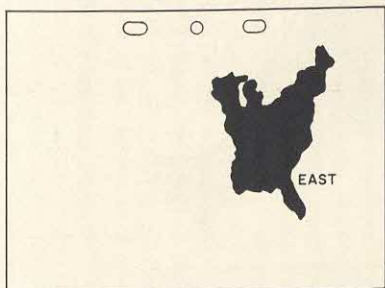
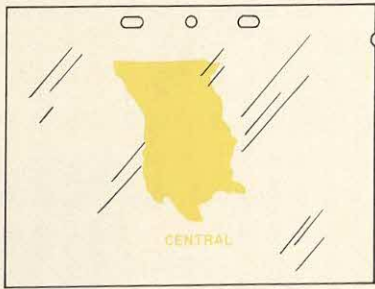
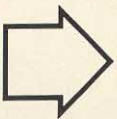
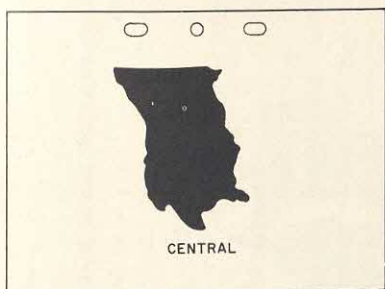
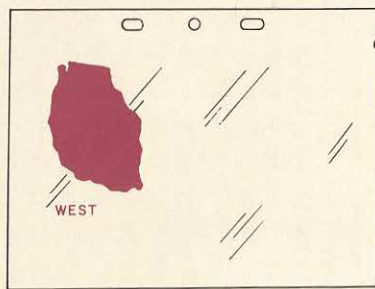
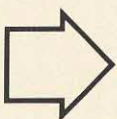
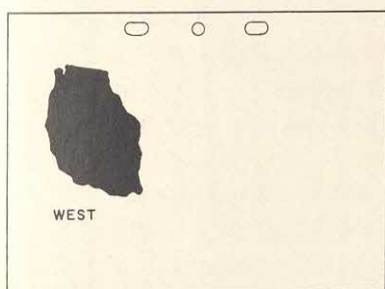
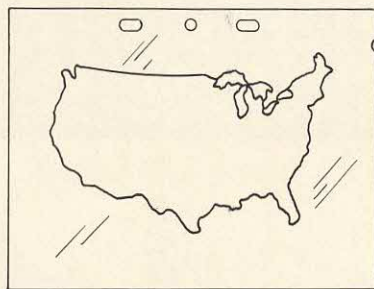
1. Proceed exactly as in step one, Stage One by putting a translucent sheet over the map and tracing it in a bold outline in black ink. (Or use the master sheet in Stage One, if you are carrying out this procedure step by step.) See Color Plate 5.
2. Put the master made in step one, if it has registration holes punched in it, on a drawing board equipped with a pin bar. Otherwise tape it down to a desk or over a map you are tracing. Now, tape down or place on the pin bar a new translucent sheet and draw a black ink line marking off the inland North to South boundary of the Western zone. Now using a brush or a felt-nib pen fill in opaque black ink from the boundary to the West Coast border. (On this sheet, only the solid mass of color appears in black ink, plus whatever labels are desired. Such labels must not be located so they will overlap other labels on other layers.) See Color Plate 5.
3. On top of these two master sheets place another translucent sheet, and tape it down. Using black ink and a broad point pen and a brush as in steps one and two, draw the Central zone boundary from North to South, then fill in another solid block of black ink from the Western zone border, being careful not to overlap the zones. See Color Plate 5.
4. Place the last sheet of blank, translucent paper needed on top of the others and tape it down and similarly fill in the Eastern zone area up to the Eastern border with black ink. If you have actually done this work you now have four translucent masters in black ink: one with the map outline, one with the Western zone area filled in solidly with opaque ink, one with the Central zone area also in black, and one with the Eastern zone area filled in. See Color Plate 5.
5. Select the proper diazo color sheets, and expose and develop each of the masters in turn just as described in steps two and three in Stage One. To do this, select one sheet of each of the following colors: black, red, yellow, and blue and print the desired black image master. See Color Plate 5.
6. Now, mount each of the clear film sheets with its colored image on a cardboard mount frame by taping down each successive layer. Tape all four edges and take pains to achieve perfect registration when each sheet is laid down. Pin-bar drawing or assembly boards are convenient for this purpose, but registration may nevertheless be achieved by using a system of registration marks or punching a hole in each sheet

MAKING DIAZO FILM LAYERS

**A Translucent Master
for Each Print**



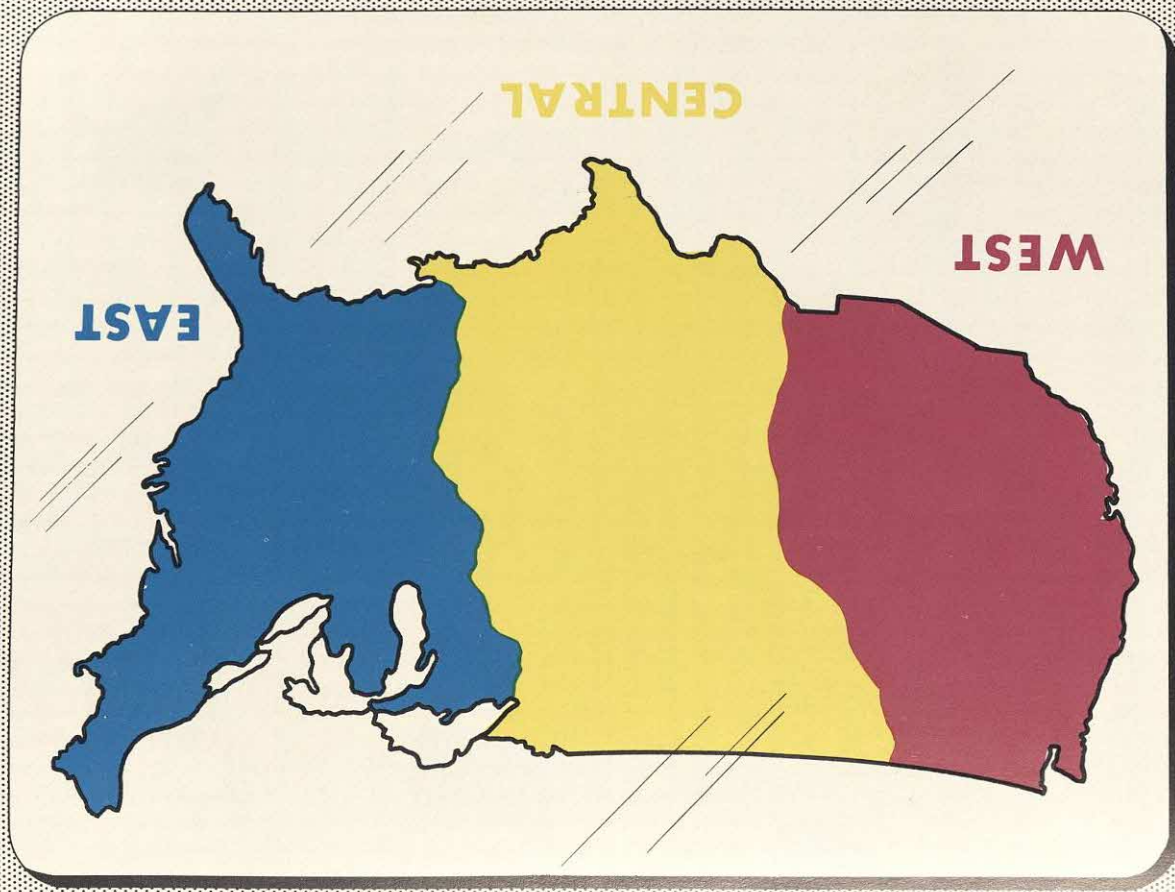
**Diazo Film Exposed
and Developed**



Layers are Then Taped or Hinged Together.

Color Plates 5 and 6. These diagrams illustrate the nature of the processes and the kind of work performed by teachers and technicians in preparing translucent masters, developing the diazo-coated film layers in color, and in making the final projectual by taping and hinging them in place on the mount frame.

The Next Page Shows the Completed Projectual.



in the same location. Many transparency makers prefer to place one or more weights over a transparency during the taping process to prevent possible buckling. Stapling pliers, large scissors, a book, or other handy materials of this sort may suffice. This step ends *Stage Two* because you now have a single static transparency in four colors. You are now ready for Stage Three. See Color Plate 6 and Figures 6-29 and 6-30.

STAGE THREE: MAKING A DYNAMIC TRANSPARENCY

This is the process where you wish to prepare a series of acetate sheets, each with its own image in its own color, thus building up a presentation one step at a time. *Stage One* and *Stage Two* provide all the necessary operations, except the mounting process. Mounting and hinging the acetate sheets is, in *Stage Three*, the crucial process. With the goal clearly in mind we turn to the operations necessary to make a coded outline map of the United States. Recheck the processes diagramed in Color Plates 5 and 6.

1. Prepare four black ink master sheets as in *Stage Two*.
2. Expose and develop each of the masters to produce four clear acetate sheets, each with its own colored portion of a total projectual exactly as described in *Stage Two* preceding and shown in the color illustrations.
3. Select a cardboard frame and mount the map outline on the back of this frame by taping all four edges. See Figure 6-29.
4. Now assuming that the Western zone portion needs to be presented first, followed by the Central and Eastern zone portions, hinge them at the left edge of the front side of the frame in that order, always in perfect registration. Special adhesive-backed hinges are available, and the suggested method is to hinge each acetate sheet in the same spot in two or three different selected places and then to staple through in this case each set of three hinges twice. Each overlay may now be swung into place as needed with the base sheet always in place as the bottom layer. Successive layers may be taped in place at the left, or at other edges if the sequence needs to be varied, but hinges and staples provide the ideal method. The details of the process are shown in Figure 6-30, and Color Plate 6.

The reader is cautioned to consider the processes just described as simple examples of what is a mechanical process that accompanies an imaginative visualization of an idea or a chain of them. Answering the question, *What needs visualization* and how can such visualization be best

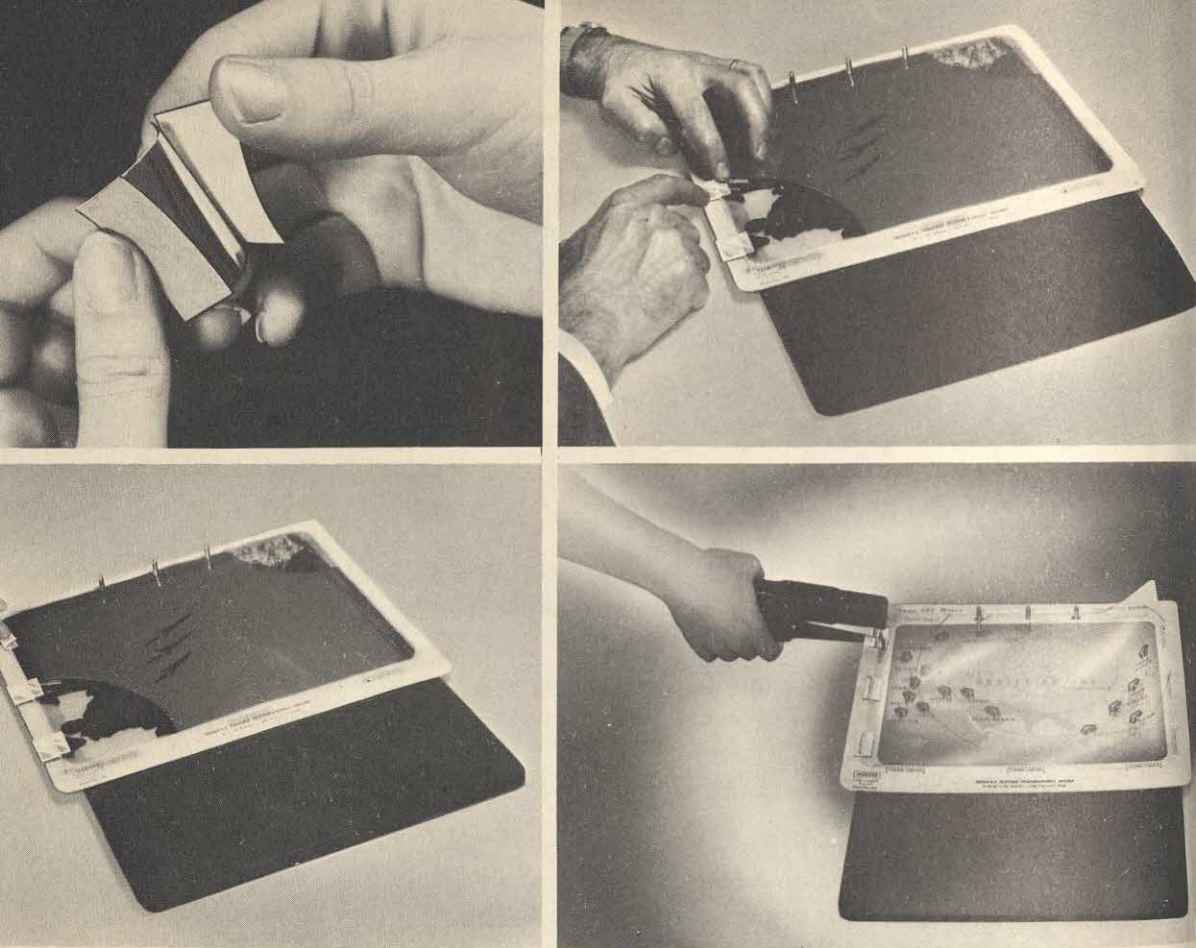


Figure 6-30. These four pictures show the steps to carry out in using the Techinge process. (Courtesy Tecnifax Corporation, Holyoke, Mass.)

First, expose the adhesive on the back of the Mylar plastic hinge by removing the protecting paper covering.

Second, insert the hinge, adhesive side up, under the transparency sheet, and repeat as shown.

Third, fold the hinge over the top even with the edge of the hinge under the transparency. Avoid wrinkling the hinge by folding it over carefully.

Repeat for all layers, then staple twice through each of the three sets of hinges. Remove the frame from the pin bar and cover the three holes with a strip of quarter-inch opaque tape.

implemented? requires some wise decisions that may not be easy. Therefore it should be pointed out that there are many operations, more complicated and more challenging, that an increasing number of good teachers have learned to perform. The operations in Stages One, Two, and Three are basic; others will take further study and experimentation. Here are a few to look up in other references.

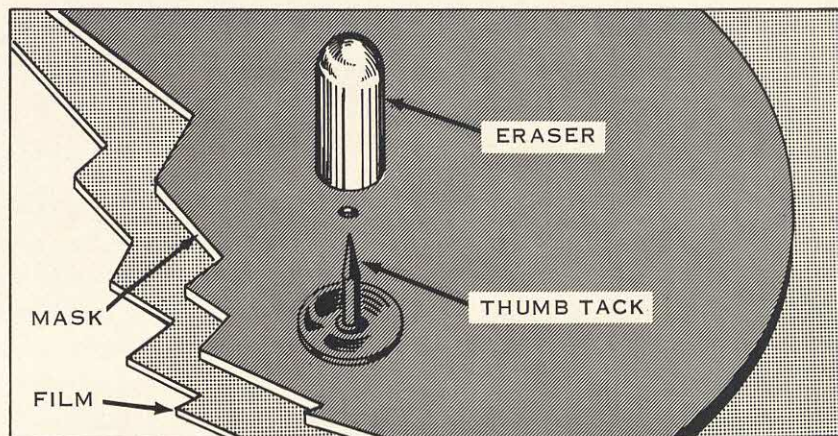
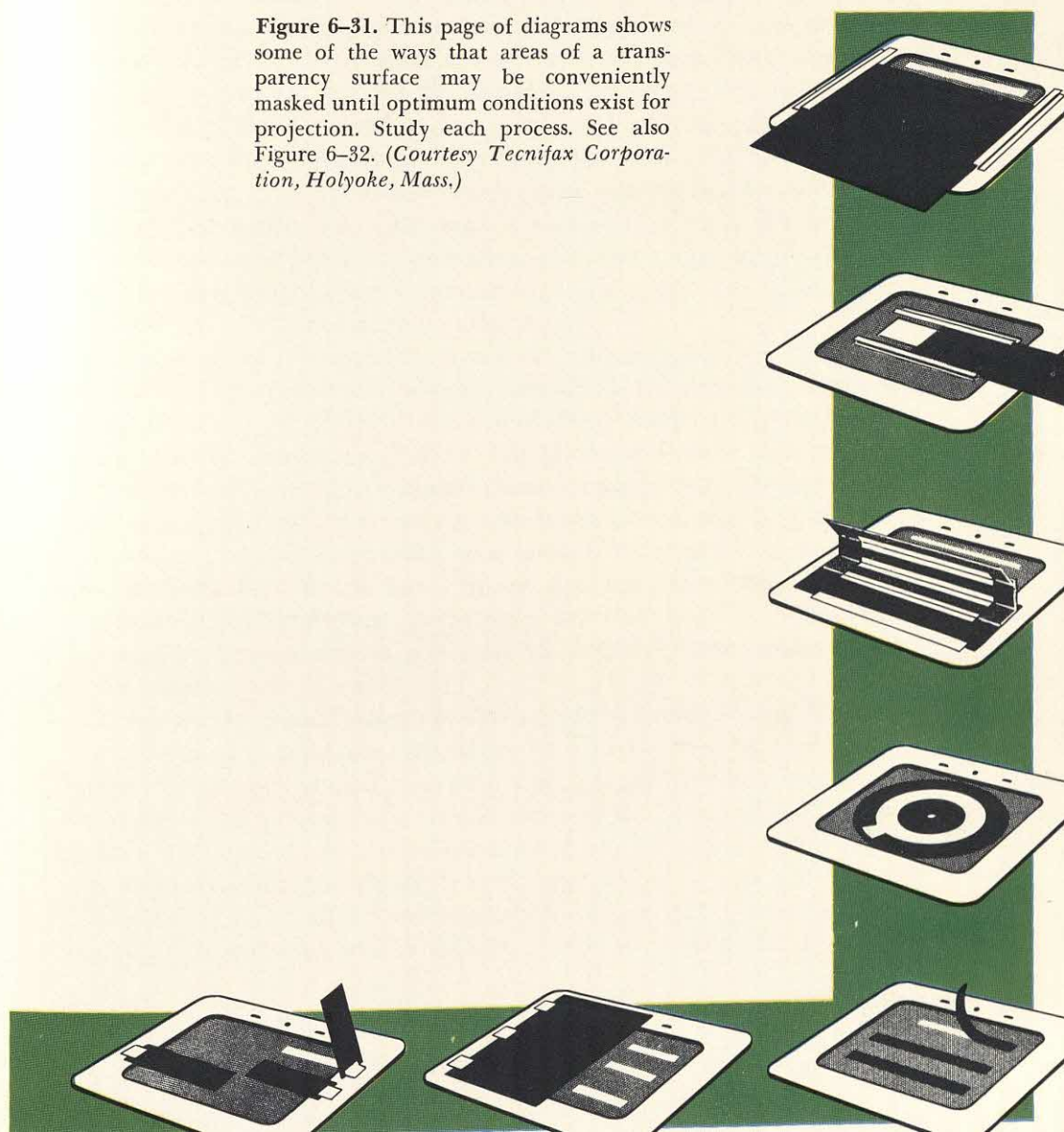


Figure 6-31. This page of diagrams shows some of the ways that areas of a transparency surface may be conveniently masked until optimum conditions exist for projection. Study each process. See also Figure 6-32. (Courtesy Tecnifax Corporation, Holyoke, Mass.)



duce blue line images when exposed with a master. These blue lines serve as guides for inking in portions of a total diagram. For example, the outline map master in *Stage One* could have been used to make four translucent sheets of the outline, each of which could have been filled in, in part, for perfectly registered drawings.

Using Diazo-coated Opaque Paper. Using this heavy and opaque coated stock, blue line images can be developed, providing guide lines for cutting out silhouettes. Thus a solid map of the United States could be cut out by scissors and knife from an opaque sheet, using the accurate guide lines, and then be taped or pasted to another master sheet, exposed with, say, blue diazo film to make a solid blue United States map area surrounded by a clear, colorless area.

Using Diazo Reversal Film Sheets. This coated film sheet, when exposed with the same United States map cut out of heavy paper and taped to a master and then developed in water instead of ammonia, would provide a clear, colorless, windowlike map area surrounded by amber. After drying, this so-called reversal master is exposed with selected coated film sheets to print any background color desired, or with a special dense black sheet providing a clear, colorless map window, surrounded by dense black.

The Masking Process. Any area of a transparency may be masked off by hinging opaque paper to a portion of the image, thus uncovering that portion at the desired time. Channels in which masks may be moved up and down or from side to side may also be used.

Using Regular Photographic Negatives. By one process negatives may be exposed with a coated film whose trade name is Reversal Foil, developed and subsequently exposed with Continuous Tone Projecto-Viewfoil, in this case, all Ozalid Company products. The photo positive is thus produced dry and ready for taping to a mount frame for projection. Photographs on lightweight paper, either as snapshots or larger prints, may be transferred to a diazo-coated film with results good enough for some kinds of material not requiring fine details and delicate shadings. Excellent results for transparency projection are obtained by printing an 8-inch by 10-inch film positive from a regular photographic negative, then taping it to a mount frame.

Using the Polaroid Camera to Photograph Graphic Source Material. Polaroid 46L film produces transparencies, size $3\frac{1}{4}$ -inch by 4-inch. Such transparencies are valuable for producing graphic symbols for use in preparing masters. Actually by manipulation of the height of the Polaroid Camera on its stand, the size of the symbol can be varied within limits.

Using a Photographic Enlarger to Change Size of Images. If a 2-inch by 2-inch slide, or a Polaroid transparency in the size of $3\frac{1}{4}$ -inch by 4-inch, is put into an enlarger and focused on a sheet of translucent paper, the

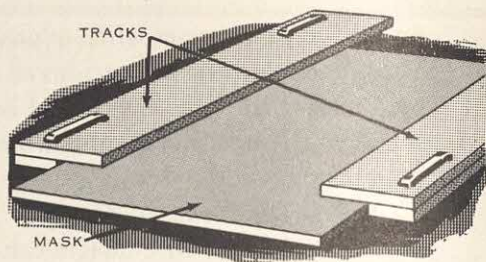


Figure 6-32. These pictures show transparency masking ideas in actual operation. Note the simple way of making slide tracks by cutting quarter-inch and half-inch strips, then stapling them down and inserting a sliding mask. (Courtesy Tecnifax Corporation, Holyoke, Mass.)



image size may be changed as desired and projected onto a sheet, then traced in pencil, and later inked in, thus preparing single or multiple master images for exposure and development.

Many exciting possibilities for teaching materials are opened to the teacher by this aspect of technology. However, such creative work places a somewhat heavy burden upon the teacher to prepare his own materials along lines described in the preceding pages. This burden can and must be lightened by school administrators who place great value on high quality teaching. Materials and supplies, convenient facilities, qualified coordinators and assistants, an increase in the number of "free" periods per week, and last, but not least important, recognition of good work are the ways in which administrators must facilitate the work of willing, talented teachers.

Problem-Solving Activities

1. Make a list of five or six topics that indicate crucial but short processes that can be effectively shown by teacher-made motion picture sequences in one or more of your future courses. Take any one of the processes and make a sequential list of scenes, trying to write up the details of the action you want to catch on film. Refer to the *helpful hints on filming*, especially items 2 and 6.
2. If your instructional technology laboratory makes it possible to do so, use the dry-mount tissue method for mounting a particularly valuable teaching picture. If the Sealamin plastic and the press are available, laminate a valuable map selected from a magazine or newspaper.
3. Select a series of useful maps and pictures from current sources and tape them (using 3M, No. 810 tape) to oaktag of the proper size for easy manipulation in the opaque projector.
4. Make a list of ten dynamic type (verb first) headlines growing out of your valid teaching purposes for future classes. For any one of your topics make a display plan showing how pictures would be balanced and arranged effectively. Use a 3-D arrangement if you can think of good objects to use.
5. Bring to class a well-selected diagram of significance in your future teaching activities and prepare to make a handmade slide using etched glass. Your drawing of no more than 3-inch by 2.75-inch size (horizontal aspect only) may be traced directly from a book or magazine or you may sketch it on paper first and then trace the outline on the glass with a soft lead pencil. Follow the suggestions in the step-by-step procedures described in the text for $3\frac{1}{4}$ by 4-inch etched glass slides. Project your finished slide along with those of your classmates and note how you could have improved your content and technique.
6. As time permits select postcards, pictures, and maps and convert them into slides by a single-lens-reflex camera in color, or by the Polaroid Copy Maker in black and white. If possible, draw some of your own maps, diagrams, and graphs as suggested in the text and photograph them along with your pictures.
7. Sketch out a significant drawing, diagram, or map in approximately 7-inch by 9-inch size, preferably in a horizontal arrangement. Now get the needed material mentioned in your text and prepare a master for printing. Use the same sketch, or a different one if you have time, and make up several masters, breaking up your sketch into separate portions for a color treatment. Print all your masters in different colors and tape them onto a frame to make a static transparency, or hinge them and staple them into registered positions so they can be used as a multiple overlay.
8. Do you perceive that the use of graphic symbols of all kinds is demanded in the production of displays (bulletin boards and flannel boards) and in the preparation of transparencies and graphs?

9. If a pupil brought you a cartoon that you desired to use in your teaching, by what physical ways could you use it? What are some activities that you could set up that would encourage students to react to it or use its content intelligently? (Do you perceive this cartoon problem as a problem in communication? How does your whole course in instructional technology help you decide what to do?)
10. Describe at least two different exhibits that you and your future pupils could produce together as a classroom activity that could be displayed publicly downtown. Be sure to state the important headline. Based on your text reading, and one or more film or filmstrip presentations, work out a statement of basic principles for the construction of school displays.

Available Technological Materials for Class Use

- Bulletin Boards: An Effective Teaching Device.* 16mm motion picture. Bailey Films. Color. 11 min. (Use to present basic display theory. Determine specific teaching practices characteristic of the medium.)
- Bulletin Boards at Work.* Filmstrip, 42 frames, B & W. Wayne State University. (Use selected frames to illustrate basic principles and as a basis for evaluation of principles by students. Also as a basis for class exercises in improving headlines and balance of specific displays.)
- Creating Instructional Materials.* 16mm motion picture. McGraw-Hill. B & W and color. 15 min. (Use to present examples of production of instructional materials by teachers and pupils. Emphasize problem-solving nature of pupil projects and the valid educational objectives involved.)
- The Diorama as a Teaching Aid.* Filmstrip, 58 frames, color. Ohio State University. (Use to present steps in the construction of Dioramas.)
- Handmade Lantern Slides.* Filmstrip, 50 frames, color. Ohio State University. (Use to present fundamental production techniques, then provide materials for preparation by each student in the class.)
- Handmade Materials for Projection.* 16mm motion picture. Indiana University. B & W. 20 min. (Use to present basic steps and characteristics.)
- How to Keep Your Bulletin Boards Alive.* Filmstrip, 32 frames, color. Ohio State University. (Use to present information about fundamentals of display theory. Use *Bulletin Boards at Work* next as a basis for evaluation.)
- How to Make and Use Dioramas.* 16mm motion picture. McGraw-Hill (Syracuse University). 20 min. (Use first portion to present basic steps in the process of construction.)
- Lettering Instructional Materials.* 16mm motion picture. Indiana University. B & W. 20 min. (Use to explore mechanical lettering devices and techniques for all kinds of materials.)
- Making Geographic Models.* Filmstrip, 55 frames, color. Ohio State University. (Use as a basis for production techniques. Examine and evaluate pupil activities.)

- Photographic Slides for Instruction.* 16mm motion picture. Indiana University. B & W and color. 10 min. (Use to present general processes for making color, black and white, and Polaroid slides for a variety of classroom purposes.)
- Relief Models.* 16mm motion picture. David Lipscomb College, Memphis. Color. 10 min. (Use to present basic steps in construction and to explore teaching possibilities.)
- Poster Making: Design and Technique.* 16mm motion picture. Bailey Films. Color. 10 min. (Use as a means of presenting basic steps, and to stimulate creative planning and construction.)
- A Simple Exhibit Technique.* Filmstrip, 40 frames, color. Ohio State University. (Use as a source of information.)
- Tape Recording for Instruction.* 16mm motion picture. Indiana University. B & W. 15 min. (Use to point out good recording practices.)

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7

LEARNING TO OPERATE THE INSTRUMENTS

Some remarkable things are happening to the classroom environment in this technologically advanced age, all of which concern the teacher. The symbol of all this action is the *button*. In some classrooms hidden projectors project on command through rear screens, the shape of a room can be altered by moving partitions to new locations, screens can be lowered and raised, and darkening systems can be operated, all by pushing buttons. The teacher now has to decide where to be standing so the lights may be dimmed during the introduction of a film, so that when it has been projected and lights are again needed, they will come on at a low level to prevent temporary retinal shock. Some very special classrooms have elaborate lecterns to pin down the teacher in front of a control board, and thus the teacher enters a new era of planning where timing, scripting, and programing become crucial.

But yet in some places, the money has not yet been appropriated to install one double electrical outlet in each room to permit the use of just one filmstrip projector, to say nothing of the rear screen complex described above. So probably for several years we will face the common situation in which we use the array of technological materials under what we may call the conventional system, and it is with the operation of these instruments that this chapter is concerned.

Teacher Responsibility

First we need to point out that it is the teacher who is responsible for the selection and guidance of learning activities. Despite the willingness of some teachers to hide behind the lame excuse, "I dare not deviate from the course of study," the imaginative teacher, the one who finds the unique way to achieve valid objectives, is the teacher who not only makes newspaper headlines and earns the respect of his students and their parents, but also is the teacher who is considered for the new supervisory position, or gets talked about at principals' conventions.

The teacher needs to keep abreast of new developments in his field and also of what materials and devices are being or have been made available locally for classroom use. The operation and use of all projectors ready for requisitioning, the copying cameras, the laminating and dry-mount press, the lettering devices, the spirit duplicators, and the tape recorder, with its listening-response aggregate boxes and headphones, should be in every teacher's repertoire of skills. There is no better way to prepare for the methods of the future than the steady growth in skillful use of tools and methods that are available today. So we point out that teachers should accept responsibility for keeping abreast and alert, keeping open-minded, and exerting the effort to try the old tools, methods, materials,

and devices that have long been used, and then to go on to innovations with old tools, and finally to experiment and try out new devices as the local school authorities provide them.

On a day-to-day basis a teacher's responsibility for the use of instruments may be reflected in two distinct ways, namely, (a) in actual personal operation of the projectors and players as needed, singly or in combination, or (b) in the supervision of operators sent in upon request for specific assignments.

It is again the teacher's responsibility to make arrangements and to see that the students in his care have an optimum viewing, listening, and manipulation environment, as described in detail in Chapter 3 under the topic of *Control of Physical Arrangements*.

OPPORTUNITIES FOR TECHNICAL SKILL AND DEVELOPMENT

In this chapter we shall discuss the operation of basic instruments only. Rather than discussing all kinds of projectors and players, we shall discuss operational procedures in general, supplementing this guidance by illustrations of both a specific and general nature. In acquiring needed operational skills, teachers either have opportunities during their preservice preparation programs or they must undertake to learn equipment operation in their own schools. Some university and college teacher preparation programs involve required laboratory exercise with equipment units. Generally not enough time is provided for mastery, and besides, most frequently, prospective teachers learn to operate one brand of a projector and player and then find another brand in their schools. Hence teachers need to ascertain just what kinds of teaching tools are available in their own schools and then take steps to have one or more practice sessions with this equipment to gain confidence and efficiency in setting up and operating it.

In an increasing number of teacher preparation schools, prospective teachers are taught to operate projectors and players by a process of self-instruction. By using ditto guide sheets, flip charts, slides, and recorded tapes, students are given procedural instructions as they go from station to station. Other schools have organized a crew of laboratory instructors, who guide each prospective teacher through the operation of each projector and player, allowing for additional practice sessions and a final check in a simulated classroom situation. Many public school systems are today providing similar in-service education for teachers so that they may operate some or all instruments in their own classrooms as desired, in this way the teachers are independent of the crew of pupil operators supplied by the school and audiovisual coordinator. The following pages are designed to

offer significant technical information to prospective teachers about projectors and players that will assist them in whatever laboratory learning experiences in which they are encouraged or required to participate, at undergraduate or at in-service education levels. We are concerned with fundamentals that will facilitate learning new facts and operations with additional and new instruments.

THE BASIC INSTRUMENTS

Instruments is a term associated with technological development, and it is now appropriate for the classroom too. We have already pointed out that a film can only be used if the instrument, that is, the projector, is operating properly and can be operated. A tape can be played as an extension of the teacher if the tape recorder-player instrument is in good working order and the teacher or his agent knows how to start and run it.

Therefore we turn to the very real and important problem of control of the mechanical, electric, and electronic instruments that can present audio and/or visual images, or the spoken word of a teacher, who for the moment is elsewhere, for vital use by the learners. First we turn to the filmstrip and 2-inch by 2-inch slide projector.

The Filmstrip and 2-Inch by 2-Inch Slide Projector

Beginning teachers will be almost certain to find several combination filmstrip and 2-inch by 2-inch slide projectors available for reservation in their schools. Some schools have, however, purchased projectors that can be used for slides only. In the combination projector there is usually a basic projector body with two additional interchangeable units, the filmstrip unit and the slide carrier or changing unit. These projectors are extremely easy to operate, but, nevertheless, teachers must be prepared through practice to handle this mechanical job without clumsiness, since rarely are operators from a school-building service crew dispatched on request for this purpose. Services like that are of necessity reserved for more complicated instruments.

There are many brands of projectors, and only a few will be shown in the illustrations. A given school system may, of course, have a number of brands available, hence beginning teachers need to complete their operational practice on the job, with a few sessions in the audiovisual equipment operation laboratory serving as an introduction. This discussion will therefore present some of the critical procedures preparing the reader

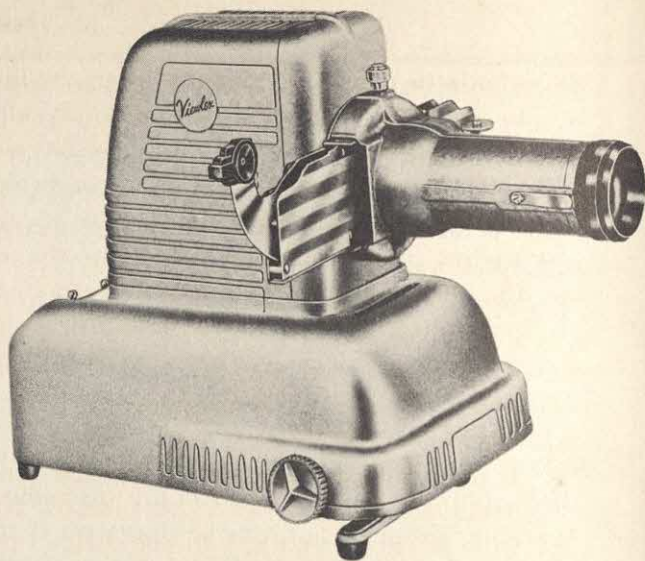
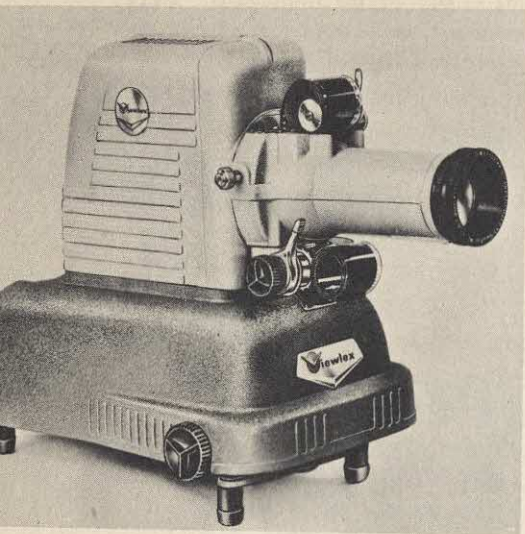


Figure 7-1. These pictures of Viewlex filmstrip and slide projectors show that the filmstrip unit may be removed and a manually operated slide carrier inserted to convert the projector to a 2-inch by 2-inch slide projector. Identify the following features in the filmstrip projector: (a) The filmstrip advance and reverse knob, and (b) the framing lever. Suppose you wish to remove the filmstrip attachment and insert the slide carrier as shown in the second picture. How must you turn the head in order to remove the attachment? To answer this question study the position of the thumb screw that holds the slide carrier and filmstrip attachment in place in the two pictures. (Courtesy Viewlex, Inc., Holbrook, L.I., N.Y.)

for laboratory sessions, for self-study of the projector operation process, or for practice in his new position.

FILMSTRIP PROJECTOR OPERATION

1. Lift the projector out of its case, connect the cord to the electrical outlet or to an extension cord, point the projector at the screen, if it is a separate fixture, and make sure that the filmstrip unit is inserted properly, turn on the light and blower switches, and then do these three things:
 - (a) Focus the light field by turning the lens one way or the other until the edges of the light field are sharp.
 - (b) Center the projected light field on the screen.
 - (c) Make sure that the field of light is even and bright. If there are dark or bright areas, or if there are dark streaks present, report it and ask that the service technicians make the needed adjustments, immediately or later.
2. Take the filmstrip out of its container and, if it is a single-frame filmstrip (Each frame is smaller than the picture area in a 2-inch by 2-inch slide. Precisely, the dimensions are 17mm by 23mm according to ASA

standards.), grasp the beginning of the filmstrip and unroll the strip to reveal the title or focus frame right side up (readable). Now rotate title (and the whole filmstrip of course) clockwise to the 6 o'clock position as you stand at the side of the projector facing the screen, and insert it into the filmstrip slot. Push it gently, so as not to buckle the leading part of the strip, through to the teeth of the sprocket. Engage the film cautiously, making sure sprocket teeth are seated in the film perforations, and advance the filmstrip until the focus or title frame is reached. Locate the framing lever or knob and move it one way or the other until one complete picture frame only is projected on the screen. Study Figures 7-1, 7-2, and 7-3.

3. If the filmstrip is of the long-picture type (double frame, 23mm by 34mm according to the ASA standards), remove the single-frame mask from the filmstrip unit, thus adjusting the aperture size to project the larger picture area. Now find out if the pictures run vertically or horizontally. If the latter, rotate the front portion of the projector 90 degrees, after inserting the filmstrip. Insert properly as in 2. Double-

Figure 7-2. This is a picture of the Victor Soundview combination filmstrip and 2-inch by 2-inch slide projector. To project slides, all that the teacher need do to this projector is to insert the slide carrier. Filmstrips are advanced frame by frame by moving the lever. Identify the elevating wheel near the bottom of the projector between the front feet. Note also the framing knob. (Courtesy Victor Animatograph Corporation, Division of KALART, Plainville, Conn.)

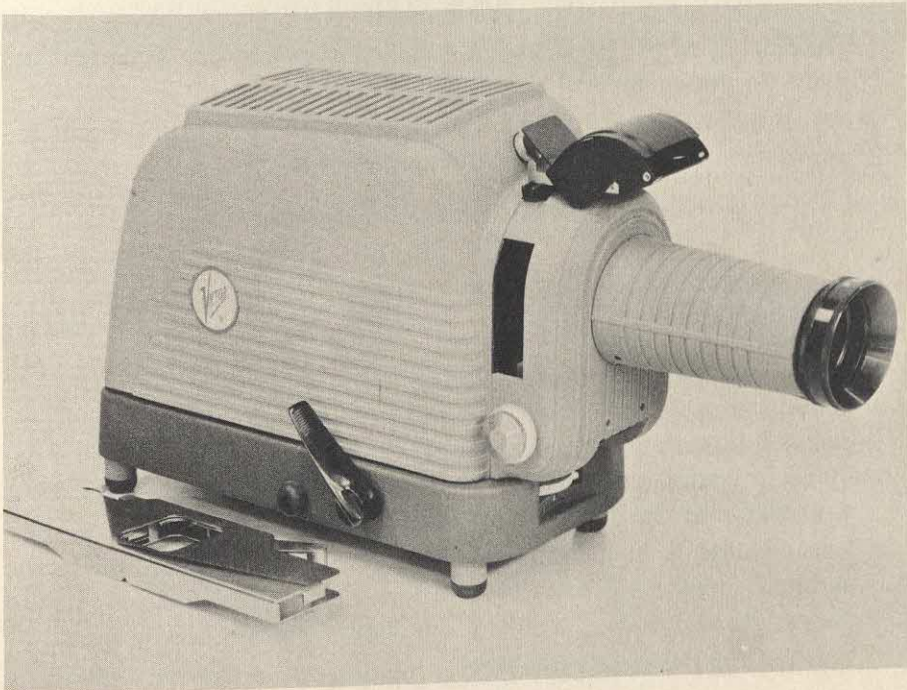
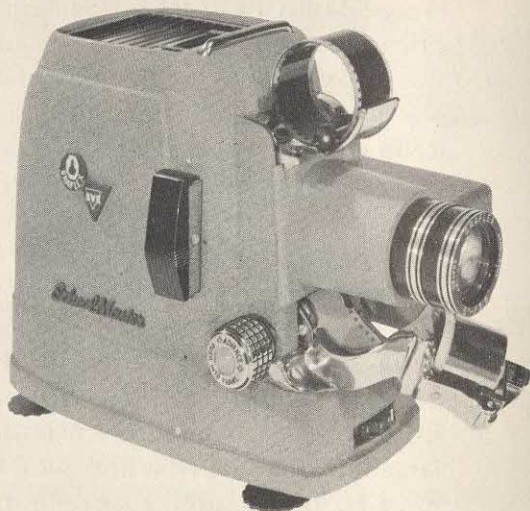


Figure 7-3. This Graflex School Master Model is also a combination filmstrip and 2-inch by 2-inch projector. It is equipped with a take-up spool that winds up the filmstrip as it is being used. Note the elevating wheel near bottom front, and the advance and framing knob. The button in the center of this knob is pushed in to release a clutch, so that the advance knob then is turned backward or forward to position the frame. When the button is released, the knob then advances or reverses the filmstrip one complete frame at a time. Note that the filmstrip, upon insertion, travels in channels as it goes into the take-up mechanism. Note also the end of the slide carrier in the body of the projector. This is pulled out to receive the slides. (Courtesy Graflex, Inc., Rochester, N.Y.)



frame filmstrips advance in two turns of the knob instead of one as for single-frame strips.

4. Focus sharply by turning the lens. Test the focus by going past the sharpest point, then return through "dead-center" focus in the opposite direction. Now return to the sharpest possible image. This exploration of focus gives the teacher the chance to know how sharp the focus can truly be.
5. Move the projector and its stand backward or forward to obtain the optimum size of the projected picture image.
6. Operate (or get help from pupils to do it) the light control system.

2-INCH BY 2-INCH SLIDE PROJECTOR OPERATION

1. Set up the projector on its stand and proceed as in (1) preceding, except as follows: prepare the projector to receive slides by removing the filmstrip projection unit, and/or inserting the manual slide carrier as needed. See Figures 7-1, 7-2, and 7-3.
2. Select a slide, hold it up to the light, so that it can be read directly, and now rotate it clockwise to an upside down position. Insert it into the carrier and move the slide carrier into its projection position.
3. Focus, using the same procedure as for filmstrip operation.

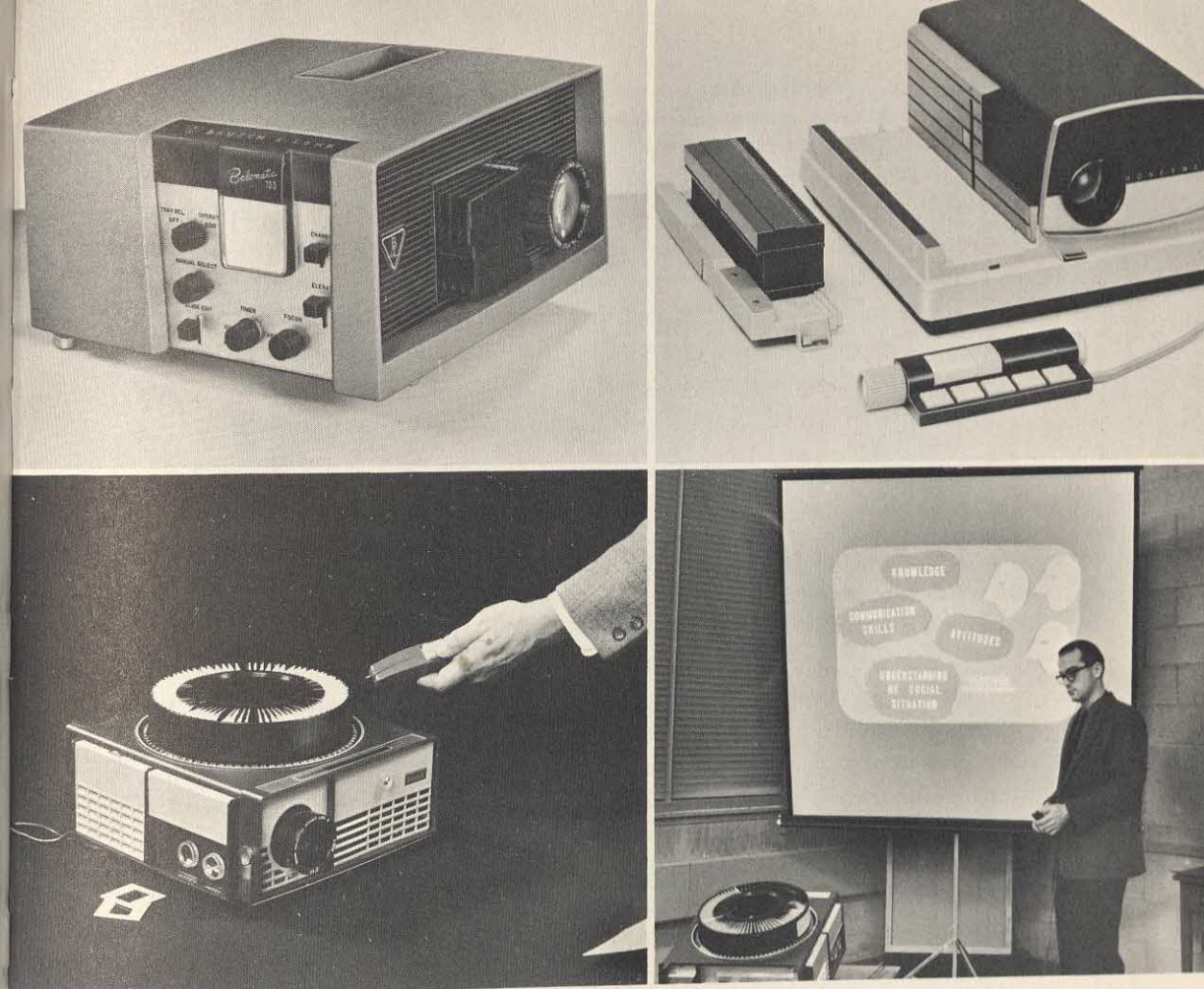


Figure 7-4. These pictures show three automatic 2-inch by 2-inch slide projectors and one classroom situation. When these projectors are equipped with 3-inch focal length lenses they may be operated at the front of the classroom and controlled by a short remote control cord. With a 7-inch lens they may be operated from the rear of a 36-foot long classroom with one or more remote control extension cords, providing of course a 70-inch projection screen is available. (Courtesy Bausch and Lomb Incorporated, Rochester, N.Y., first picture; Honeywell Photographic Products, Denver, Colo., second picture; Eastman Kodak, Rochester, N.Y., third picture; fourth picture photographed by the author.)

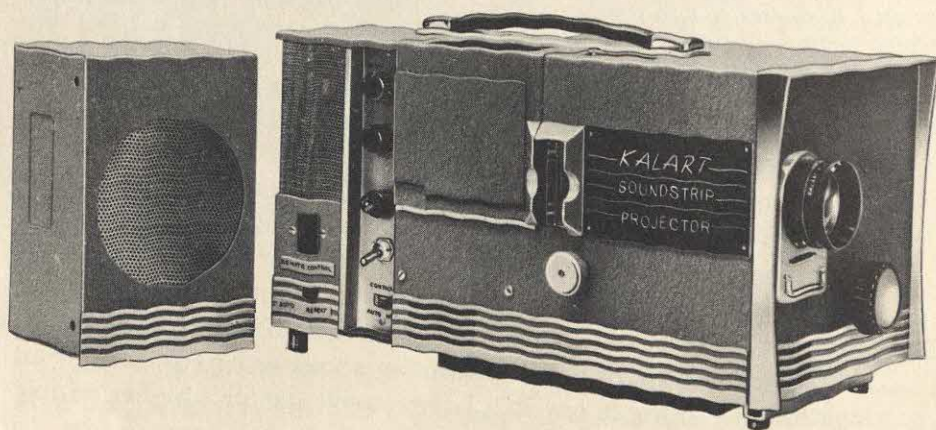
4. Move the projector forward until the optimum size of picture image is obtained on the screen. A lens of longer focal length to make the size of the image smaller in a given room may be needed. Trouble is frequently encountered when teachers project vertical slides. Unless the projection screen is square and mounted so that the bottom is about four feet above the floor, shadows of viewers' heads will appear in the projected image area. The solution is to move the projector closer to the screen, or to obtain another objective lens of longer focal length, or of course to obtain a larger screen and/or a higher ceiling.

5. Some slide carriers are of the so-called semi-automatic type, and there are a large number of manual and automatic projectors on the market that employ a variety of slide magazines. Each of these has operating features of a unique nature. The newer automatic projectors may be focused by remote controls. Teachers should ascertain their special needs for such automatic equipment, and, if it is available in their schools, they should request instruction from the principal or his appointed assistant in charge of technological services.
6. Be sure to dim the lights to $\frac{1}{10}$ foot candle of illumination.

SOUND FILMSTRIPS

A few words about sound filmstrip projection details are warranted. If the compact sound filmstrip player-projector instruments are not available, teachers need only set up and operate a regular filmstrip projector and any classroom-type record-player unit, or tape player. When using such media in combination it is essential to explore the nature of the first title and pictorial frame of the filmstrip and to determine the precise manner in which opening music and narration fit the beginning frame, and to determine also the kind of signal that calls for the change to the next pictorial frame. Once this information is known the presentation can be started in proper synchronization. Thereafter signals will dictate the projection interval. If a mix-up occurs, and the content is unfamiliar to the teacher, there is little to do except stop and repeat portions of

Figure 7-5. A number of especially designed sound filmstrip projectors are available. In some cases the sound component is on tape and in others on a disk recording. In the Kalart soundstrip projector shown, the sound source is an optical track printed photographically on the film stock of the filmstrip next to the pictorial frame. Thus regular filmstrips using tape or disk commentary cannot be projected on this projector. (Courtesy Victor Animatograph Corporation, Division of KALART, Plainville, Conn.)



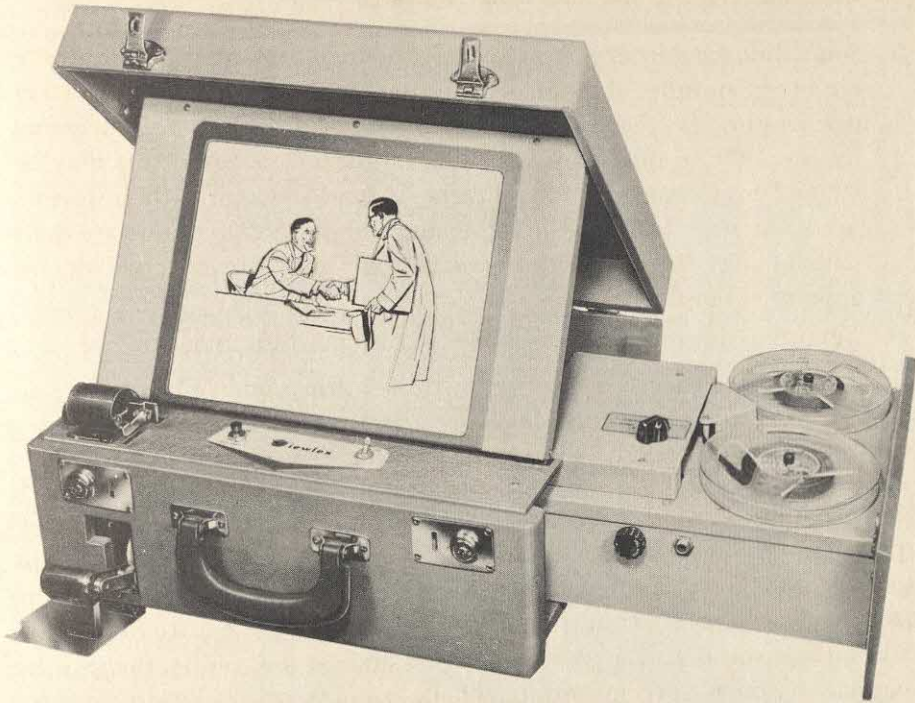


Figure 7-6. This portable Viewtape unit, in addition to its commercial applications, may serve classroom self-instruction purposes effectively. This unit provides for sound filmstrips that depend upon recorded tape for the sound component. (Courtesy Viewlex, Inc., Holbrook, L.I., N.Y.)

Figure 7-7. The lack of special equipment may be offset by the use of other instruments used in combination such as this Newcomb record player and a regular filmstrip projector as in Figure 7-1. The loudspeaker may be positioned desirably at the front of the room. The teacher or operator would project the starting filmstrip frame and then start the record, or the record player and loudspeaker could be positioned in the front of the room with an operator to assist when projection is about to begin. (Photograph by David H. Curl, The University of Connecticut, Storrs, Conn.)



pictorial and sound content in the attempt to match picture and sound, or go back to the beginning and start again.

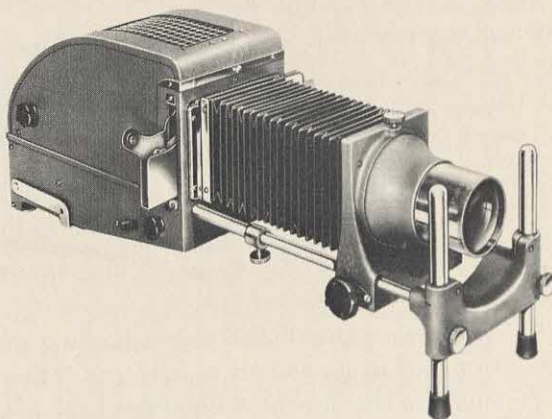
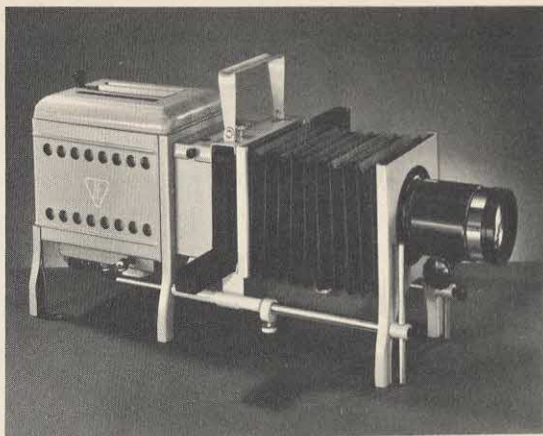
The 3¼-Inch by 4-Inch Slide Projector

The development of miniature color-slide technology interrupted for a time, or at least slowed down the instructional use of the larger 3¼-inch by 4-inch slide, but two new technical processes have restored its prominence although in slightly different instructional directions. The newer developments are (1) the short exposure technique in which a device used with an overhead lantern slide projector that resembles a giant camera shutter controls the time a projected image is on the screen, and (2) the development of the Polaroid Land Camera and transparency film. This latter technology makes possible the three-minute slide in either 2¼-inch by 2¼-inch, or 3¼-inch by 4-inch size. Thus today every old or new lantern slide projector, of regular or overhead design, should be pressed into service as an extremely valuable tool for teachers. Both of these projectors may be operated easily by the teacher after a little practice carrying out the following operations, first stated for the regular or standard slide projector. In connection with the steps in this process, study Figure 7-8 for the regular slide projector, and Figure 7-9 for the overhead slide projector. Refer also to Figure 2-19.

REGULAR SLIDE PROJECTOR

1. Take the projector out of the case and put it on a projection stand or table at the rear of the classroom and point it at the projection screen.
2. Insert the slide carrier and tighten the fastening screw. Plug in the power cord to a 115V AC outlet, and turn on the lamp and blower switches.
3. Loosen the fastening screws (usually small knurled knobs) or one central rack and pinion knob and extend the bellows until the projected light field becomes sharply focused. Now set the focusing lens (the objective lens) at the front end of the bellows to the midpoint of its travel distance and readjust the bellows to get the sharpest outline of the projected light field. Center the light field on the screen by moving the projector and/or stand or by adjusting the elevating device.
4. Make sure there are no light and dark streaks or dark areas in the light field. It should be even throughout the area. If it is not, report it to the person in charge of technological services for adjustment.

Figure 7-8. These pictures show first the Bausch and Lomb and then the Charles Beseler Co., Slide King Model, $3\frac{1}{4}$ -inch by 4-inch projectors. This Bausch and Lomb inexpensive model does not have a blower. The Beseler model has a blower. Identify operational features, such as the extension bellows in both instruments, how they are lengthened or shortened, and the different fine focus arrangements. In the Bausch and Lomb projector the bellows is extended first for rough focus and then the rack and pinion knob is turned for fine focus. In the Beseler there is only one knob that controls the bellows after a releasing screw on the extension bar has been loosened. (Courtesy Bausch and Lomb Incorporated, Rochester, N.Y., top picture; Charles Beseler Company, East Orange, N.J., bottom picture.)



5. Insert a lantern slide upside down and reversed in the carrier and push the slide carrier into proper projection position.
6. Now focus the projected image; only a turn of the lens or the knob one way or the other will be required since the light field was focused in advance.
7. Make sure the blower fan is operating properly. If the projector has no blower, take precaution not to touch heated parts of the projector housing. Also do not leave slides in the heated projector more than a couple of minutes. Uneven or excessive heating may crack the glass. In cases where prolonged analysis is necessary use a handkerchief or folded piece of paper when handling the slide to prevent burning the fingers.
8. Manually operated lantern slide carriers for slides of different sizes are generally available from manufacturers of a given brand of projector. Carriers for 2-inch by 2-inch slides should not be used with $3\frac{1}{4}$ -inch by 4-inch slide projectors since the projected image will be too small. However, some projectors are manufactured to accept

- special objective and condenser lenses for the projection of 2-inch by 2-inch slides.
9. An electric pointer will allow the teacher to remain near the projector at the rear of the room. If you want to work up front at the screen, ask a trained pupil to project your slides.
 10. Be sure to dim the lights to the desirable lower level where images may be properly observed. Etched glass slides need a lower level of illumination than diagram-type images. This is also true for photographic slides in color.

THE OVERHEAD SLIDE PROJECTOR

1. Set up the projector preferably on a low projection stand (16 to 20 inches in height) at the front of the room at approximately ten feet from the projection screen.
2. If the projection mirror and lens holding unit is not already in place or permanently fixed, insert the unit, and tighten the thumb screws. Tilt the mirror to reflect the light onto the screen.
3. Plug in the power cord to a 115V AC outlet and turn on the light and blower switches.
4. Now loosen the thumb screws holding the lens and mirror unit and elevate it to get a fairly sharp focus. Then tighten the holding screws and turn the fine-focus knob until the field is sharply and adequately focused.
5. Sitting down at the side of the projector facing the pupils, lay a $3\frac{1}{4}$ -inch by 4-inch slide down on the projection stage, face up, directly readable.
6. Again adjust the fine-focus knob.
7. Remember to keep your seat at the projector, look at your class and your slide, and use a pencil to point out features. Check the focus once in a while or ask one of your pupils to check it for you. Do not keep turning around to watch the screen.
8. Operate the light control system for optimum room lighting conditions for the particular instructional task to be served.

The Overhead Transparency Projector

There are several kinds of overhead projectors now available; some are portable, lightweight models and others are large and bulky to handle although desirably rugged in construction. All of the larger and more

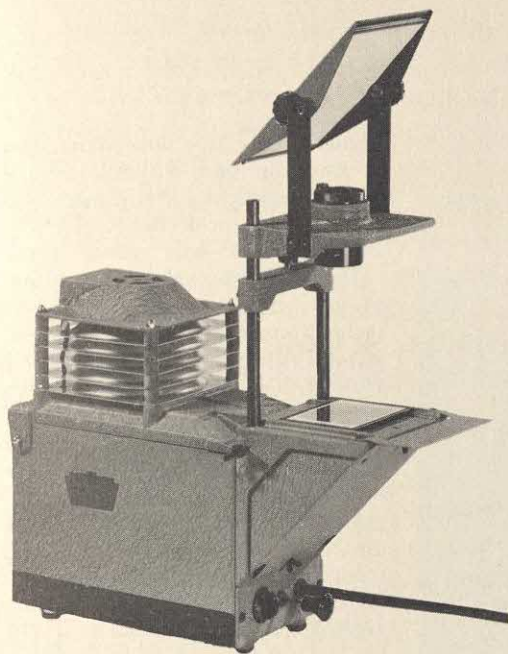


Figure 7-9. Study this overhead $3\frac{1}{4}$ -inch by 4-inch slide projector in comparison with the instruments in Figure 7-8. Is there a bellows? But is the objective lens moved away from or closer to the slide being projected? The slide is placed on the projection stage right side up, so it can be read directly by the teacher as he faces the class. Could the teacher use a pencil to point out, for example, the features on a map slide that is being projected? At the bottom front of the projector note the switch knob for the lamp and blower, also the knob that is pushed in or pulled out to obtain an even field of light on the screen. Is it obvious how the picture on the screen can be raised or lowered by moving the mirror above the objective lens? The fine focus wheel is near the lens just out of view. Note the thumb screw that is loosened to move the lens and mirror assembly away from or closer to the slide. (Courtesy Keystone View Company, Meadville, Pa.)

rugged projectors should be placed on their own mobile stands and wheeled from room to room or assigned permanently to those teachers who need them frequently. All such projectors should be placed on low stands as is emphasized in Chapter 5. All have features common to most, and some have unique features. But all may be operated easily and successfully if a few basic precautions are heeded. These instructions are as follows:

1. Wheel the projector on its mobile cart into position in the front of the room and center it on the projection screen. Make sure the head of the projector is in proper position. In studying these steps, refer to Figure 7-10.
2. Turn on the lamp switch (this switch also turns on the blower).
3. Now tilt the machine by the knobs or screws provided to position the field of light on the screen. Some projectors do not have elevating legs, instead providing a tilting head. The main idea here is to tilt either the machine itself or the movable part of the machine, as the case may be. Heads are either tilted by moving the entire head on its mounting bar, or by turning a knob at the rear of the head to move an interior mirror. Move the projector closer or farther away to adjust the size of the image on the screen.



Figure 7-10. This low stand and overhead projector with a low, small head, permits, if the teacher sits down during projection, an unobstructed line-of-sight vision of the entire screen, provided the bottom of the screen is approximately 48 inches from the floor. In this projector is the projection stage level? How is the lens and mirror system tilted? (The knob is on the teacher side of the lens.) The entire head assembly is raised and lowered by a rack and pinion knob on the post to get focus. How is the projected area on the screen (assuming sharp focus) made large or smaller? See Step 3. (Courtesy *Tecnifax Corporation, Holyoke, Mass.*)

4. Focus the edge of the projected light field by raising or lowering the head (the part holding objective lenses and mirrors).
5. Lay a transparency on the projection stage face up as you face the stage of the projector, check the sharpness of the focus, and adjust the size of the projected image.
6. Make sure that the transparency frame is properly positioned on the projection stage in a fixed place; otherwise the projected image will not be properly located on the screen. If the projector is tilted, then adjust the horizontal and vertical mounting frame guides. If they are lacking, bend the inside loop of a paper clip into an upright position and tape the clip to the projector to keep the transparency centered on the projection stage. Tape down another similarly bent paper clip to the right side of the projector to keep the transparency mount frames from being pushed too far over to the right when being projected. Now each successive frame will be positioned properly

on the projection stage and consequently the image will be properly located on the screen.

7. Adjust the microswitch, if the projector is equipped with this accessory, so the lamp will go on and off when transparency frames are pushed under the micro spring-loaded pin. It should be noted that to turn on the microswitch an acetate sheet has to be mounted on a cardboard frame, which then slides under the switch pin, and because the cardboard frame is thick enough the projection lamp is turned on.
8. Adjust the positioning of horizontal and vertical frame guides on the projector to accept both vertically and horizontally oriented transparencies. A vertical transparency demands a square screen, and one that is mounted higher on the wall, since the bottom of a projected vertical picture is lower than that of a horizontal projection. Therefore in many situations a horizontally oriented transparency is best for the teacher to use. At best, during a projection, a compromise may have to be effected as to how much of a vertical transparency needs to be sacrificed in the reduction of the area to be projected.

The Opaque Projector

The so-called opaque projector, which projects an image by reflected light, has in recent years undergone a desirable process of change. Despite this, however, these projectors are still bulky and large, somewhat

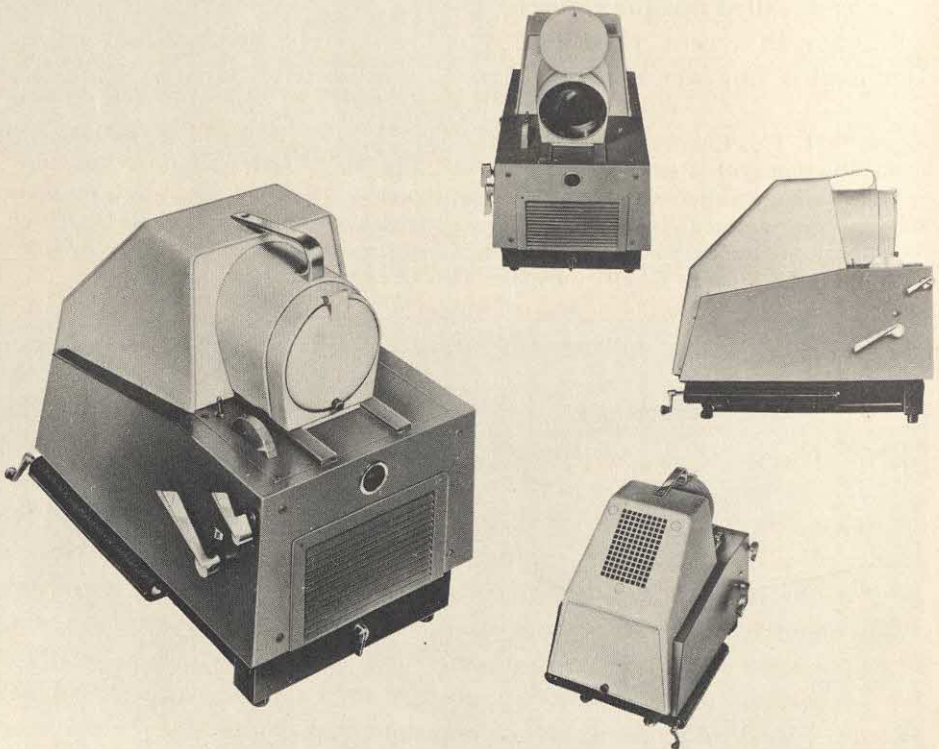
Figure 7-11. This Charles Beseler Co., Vu-Lyte II, projector is being used in a rear-of-room situation with a student projectionist. Note that a small picture is being projected. If a large, full-screen picture were projected would line-of-sight vision for some students be obstructed? Is the bottom of the screen too low? Should not the screen be mounted above the chalkboard for full use of a square image? See Chapter 3 and Figure 2-30. (Courtesy Charles Beseler Company, East Orange, N.J.)



like the rugged overhead projectors in size. Nevertheless, they are at times extremely valuable for special instructional tasks, some of which are described in Chapter 6 under the topic that deals with preparing materials for the opaque projector. General suggestions for operation are as follows:

1. Wheel the projector on a 24-inch high stand into position approximately twelve feet from the screen. Plug the projector cord into a 115V AC outlet or into an extension cord. To facilitate the study of steps in this process, refer to Figures 7-11 and 7-12.
2. Darken the room; otherwise projected images will not be of optimum brightness.
3. Turn the lamp switch on.

Figure 7-12. These views show the Beseler Vu-Lyte III opaque projector. Identify the focusing wheel near the objective lens, the feed-o-matic crank, and the elevating lock-lever at front, bottom, center. Note also the larger of two levers for lowering and raising the platen on which pictures are placed for projection, or into which pictures are fed by the cranking process. The smaller lever of the two is the mechanism for controlling the optical pointer. This projector in aisle positions will block the view of the screen unless it is on a fairly low stand. The top of the projector should not be over 48 inches high for high school pupils, and should be less, of course, for younger elementary school pupils. See Step 4 for a major precaution to take when lowering the platen. (Courtesy Charles Beseler Company, East Orange, N.J.)



4. Insert a picture or a white sheet into the left side of the projector and turn the roll-feeder crank until the image is positioned on the screen. Focus the picture by turning the knob that moves the objective lens back and forth. Materials may also be placed in the projector by lowering the projection platen. When this is done the brightness of the light will cause extreme discomfort to pupils sitting in back or to the side of the projector. *Therefore, turn the lamp off before lowering the platen.*
5. Elevate the front of the projector by loosening the holding devices and then guide the projector upward until the picture is centered on the screen.
6. Increase or decrease the size of the projected image by moving the projector farther away from or closer to the screen.
7. Make sure the projector does not block the view of pupils.
8. Insert materials while standing or sitting to the rear of the projector facing the screen. In every case the material, for example, a picture, should be so positioned on the platen that the bottom would be the edge nearest the front of the projector, or, oppositely, the top of a picture would be nearest the back of the projector.
9. To improve the overall focus when projecting a book cover the book with a piece of plate glass; otherwise the center of a book will not be in focus when the outside edges of the pages are.
10. When viewing one or more thick objects, such as crystals, the objects may have to be focused in planes, that is, one level at a time. A few trials will have to be made to ascertain what compromise is best, or how focusing on different levels of an object will make possible optimum clarity for observation. (Note: Teachers should be aware that with a single-lens reflex camera, objects and pictures may be photographed in color as described in Chapter 6.)
11. Locate the pointer on your projector, which is usually operated by turning a knob and/or moving it back and forth.

The Tape Recorder

Once teachers familiarize themselves with the nature of a tape recorder-player they can operate almost any of the regular classroom models after a few minutes of study and practice. All of these machines have similar controls even though they are to be found in different places, and operated somewhat differently on the different models. The point is a teacher (or a pupil in the class) would carry out a definite pattern of operations to record, and another set of operations to play a prerecorded tape or

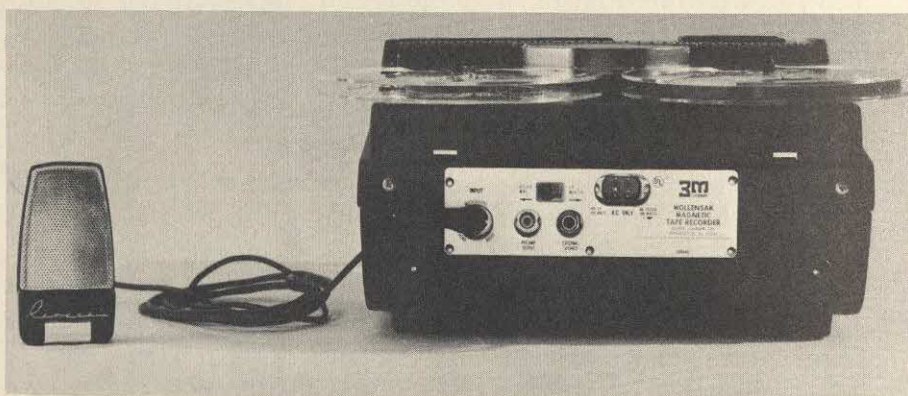
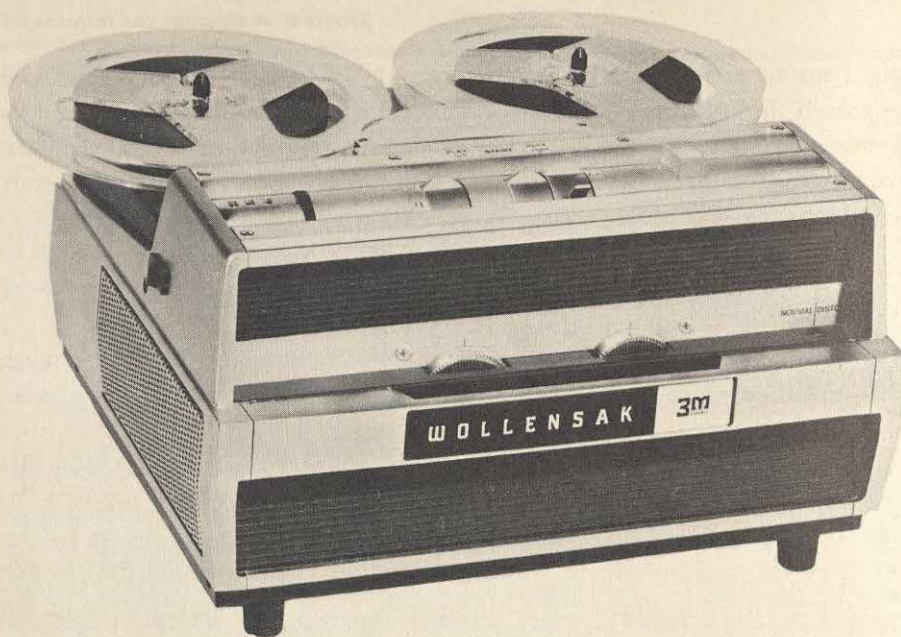


Figure 7-13. In these two pictures we look first at the front of a Wollensak tape recorder, and then at the rear. This tape recorder uses a multiple-position cylindrical key switch that turns back and forth. For example the first key is the speed switch. Toward the front the key is set at 7.5 inches each second, and, at the middle position, the recorder is off. Toward the back the setting is 3.75 inches each second. The next key is the *start* and *stop* key, and the last key at the right, set at the back position, plays the tape; at the front position the instrument records on the tape. The knob at the right controls fast forward motion of the tape and rewind action. The volume and frequency emphasis controls are just above the Wollensak label. In the rear-view picture, note that the microphone is plugged into the input jack. Note also the two jacks to the right of the input. The nearest jack is a preamplifier output that permits a connector cord to take a signal from this jack and into the input of the next tape recorder to copy a tape. The next jack is for an external speaker for better sound distribution or for earphones. In this latter connection refer to the hook-up shown in Figure 4-10. Note also the power cord plugged into the receptacle. (Courtesy 3M Company, St. Paul, Minn.)

play back what had just been recorded. Let us look at the two processes separately and treat the processes in general so that they may be applied to almost any one of the many models of classroom-type tape recorder-player machines. First let us turn to the process of recording but for both processes let us refer each general step to the specific equipment in Figure 7-13.

OPERATIONS TO RECORD A TAPE

1. Turn on the machine and let it warm up for about a minute.
2. Thread the tape to make proper contact with the "head."
3. Plug the microphone directly into the input jack of the recorder, or into a microphone mixer if music is to be added by playing disk recordings before, after, or during voice recording.
4. Test the microphone by speaking into it and at the same time observe the volume indicator (a flashing light or a VU meter), raising the volume of the recording to optimum level by moving closer to the microphone or turning the volume knob to a higher setting. Take careful note of the volume setting.
5. Set the speed selector switch to the desired recording speed of the tape.
6. Unlock the recording key guard and turn or depress the record key or button to start the machine, turn up the volume knob to the pre-determined setting, and begin the recording. Good voice recording generally demands a short distance from mouth to microphone. Try for one foot or less.
7. After completing the recording, turn volume level to zero and then turn or press the stop key.
8. Disconnect the microphone from the input jack.
9. Rewind the tape.

OPERATIONS TO PLAY A TAPE

1. Turn on the machine and let it warm up for a minute.
2. Thread the tape properly through the slot as for recording.
3. Ascertain the speed in inches per second at which the tape was recorded and be sure to play the tape back at the same speed, that is, set the speed selector switch at the same speed at which the original was made.
4. Turn or press the starter, play keys, and turn up the volume to the optimum level for whatever listening situation exists, that is, anywhere in the room directly from the speaker through the air, or

through headphones. Headphones or the aggregate headphone box is plugged into the external speaker jack.

5. Rewind the tape onto its original reel.

By looking at the preceding list of tape recording and playing operations it is obvious that teachers need to know the location and how to operate or make use of the following connections and controls: (a) on and off switch, (b) feed spindle, (c) take up spindle, (d) start and stop switches, (e) record key, (f) play key, (g) microphone jack, (h) automatic shut-off pin switch, (i) rewind lever or switch, (j) fast forward switch, (k) external speaker output jack, (l) tone controls for bass and treble emphasis, and (m) speed selector switch. This list of controls and connections seems extensive, but any normal fifth-grade boy or girl could be taught to recognize and use them; hence we do not hesitate to suggest to the teacher that a short lesson by a technician at his school plus a few practice sessions is all that is needed for him to be reasonably self-sufficient for his own classroom recording and playing operations.

SOME SPECIAL TAPE RECORDING OPERATIONS

Let us turn now to a few special recording situations that many teachers find themselves in, namely: (a) recording sound from a disk recording or a part of it, onto a tape, so that needed excerpts may be conveniently played in closer and better timed relationships, (b) recording both music and voice, and (c) making a taped copy of a tape recording, that is, making a tape copy of a master tape. A few brief directions as to some possible procedures in carrying out each of these special operations follow.

From a Disk Recording to Tape. To carry out this recording job, the teacher needs a special electrical connecting cord with a plug to fit the input jack at one end and two so-called alligator clips, (toothed, jawlike, clamping, contact points) at the other. The connector is plugged into the tape recorder input jack, and each of the two clips is clamped onto one of the two wires soldered to the back of the loudspeaker in the record player speaker case. When the record is then played the music is heard, but a part of the electrical impulse also goes into the tape recorder. Both machines are started and regular recording procedures are then used. Another way to do this is to run a special cord from the record player output directly to the tape input, but this will demand a connecting cord with plug-in connectors at both ends. But such connector cords may be made up in any audiovisual service shop or at a local radio-television shop. Or better yet, order the required connecting cords from the nearest audiovisual equipment dealer. Note the arrangement of instruments in Figure 7-14.



Figure 7-14. These pictures show how, with the appropriate connector cords, disk-recorded content may be transferred to the tape medium. In the first picture the connector cord is plugged into the record player audio output and then into the tape-recorder input. The rest of the process is straightforward operation of both instruments. The second picture, a close-up view, shows the use of the so-called alligator clips for fastening the end of the connector cord to the two posts of a loudspeaker. The other end is fitted with a regular tape-recorder input plug. When the disk recording is played the sound is heard through the loudspeaker, but the electrical impulses are also sent from the loudspeaker posts through the connector cord to the tape recorder. (Photograph by David H. Curl, *The University of Connecticut, Storrs, Conn.*)

Mixing a Disk Recording and Voice. In making up dramatic tapes, student produced tapes, and other special purpose tapes, it is often necessary to mix voices with music and/or sound effects from disk recordings. This process calls for a microphone mixer where jacks for several mikes and phono and/or tape inputs are available, each with its own volume control. When recording, each input volume control is preset, and then the volume control setting on the tape recorder serves as a master recording-volume control unit, controlling each input by the same amount at the same time. When recording from a disk, the procedure is to find the proper groove in the record and lift up the record gently, hold it in a fixed place until the cue is given, when it is dropped onto the turn table, and, when the record reaches standard speed, the volume is raised to supply the impulse to the tape recorder. After fading or cutoff, the regular voice or voices resume. Such operations call for several rehearsals, and a recording assistant as well. Classroom-type equipment for carrying out this process is shown in Figure 7-15.

Making a Tape Duplicate. Copying another tape on regular classroom equipment is easy. Two tape recorder-player units are needed. Thread the tape to be copied on one of the two tape recorders, and thread a blank reel of tape on the adjoining machine. Plug one end of a connecting cable into either the preamplifier or external speaker jack of the machine playing the master tape, and the other end into the input of the machine with the blank tape. Press or turn on the play button or key on



Figure 7-15. The arrangement of instruments in these pictures is similar to that shown in Figure 7-14, except for the addition of a microphone and a mixer for microphone and record player. Identify these units and trace the mixing process by noting the connecting cords from record player and microphone to the mixer inputs and then on to the single tape-recorder input. Observe in the top picture: (1) the rear, input view of the tape recorder, and (2) the rear, input view of the mixer. In the bottom picture the front view of each component is shown with all connections complete. In this view trace once again the mixing and connecting process. (Photographs by David H. Curl, The University of Connecticut, Storrs, Conn.)

the former, and the record button or key of the latter. Then operate the other controls concerned with volume and speed according to procedures described earlier and shown in Figure 7-13. Several machines so linked can turn out as many copies at a time as extra machines are available. Study the arrangement of equipment in Figure 7-16. A few preliminary test runs should be made to ascertain optimum volume level for copying.

Splicing a Tape. Everyone has heard of the extremely critical editing procedures carried out with magnetic tapes such as removing one word or one musical note from a recording by means of expert cutting and splicing. But here we speak of one process only, namely, mending a broken tape. This is an easy process that requires only scissors and a half-inch piece of a special splicing tape, which can be obtained from any audiovisual dealer, record shop, or tape manufacturer. The simple steps, shown in Figure 7-17, are as follows:

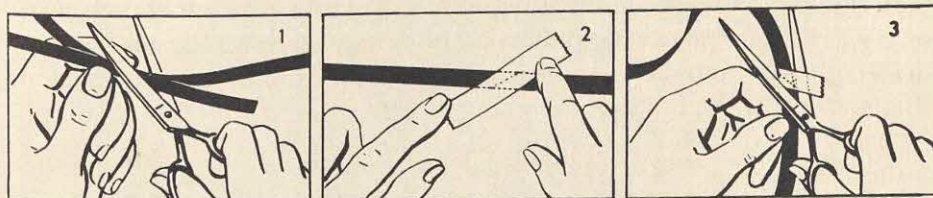
1. Overlap the broken ends one-half inch, and make a diagonal cut with a pair of scissors through the overlapped ends.



Figure 7-16. Copying a tape is an important process for some teachers to carry out. These pictures show front and rear views of a pair of tape recorders of the easy-to-operate classroom type linked together by appropriate connecting cords. The connector cord for copying links the player instrument to the recording instrument. Note that the output from the preamplifier of the master tape player on the right, bottom picture is connected to the recording input of the recording instrument. The rest of the process is simply to operate both machines paying particular attention to the problem of starting at the desirable playing and recording volume settings. (Photographs by David H. Curl, The University of Connecticut, Storrs, Conn.)

2. Match the ends precisely, shiny side up, on a hard, smooth surface, and press a neatly cut half-inch rectangular piece of white splicing tape firmly down upon them while in a precisely matched position.
3. Trim away both edges of the splicing tape, cutting into the tape no more than $\frac{1}{16}$ of an inch on each side.

Figure 7-17. These three diagrams show how simple the tape-splicing process is. Inexpensive tape-splicing devices are available that help teachers carry out the processes of overlapping, cutting, and trimming by mechanical means. The three steps described in the text are shown in the same order in the diagrams. (Courtesy Audio Devices, Inc., New York, N.Y.)



4. If critical editing is to be done before the deliberate cutting and splicing process, the process of cueing or listening to a small section of tape by moving it back and forth across the playing head must be carried out. The tape is then marked with a tape marking pencil and cut at the proper spot to eliminate a given portion of the magnetic modulation.

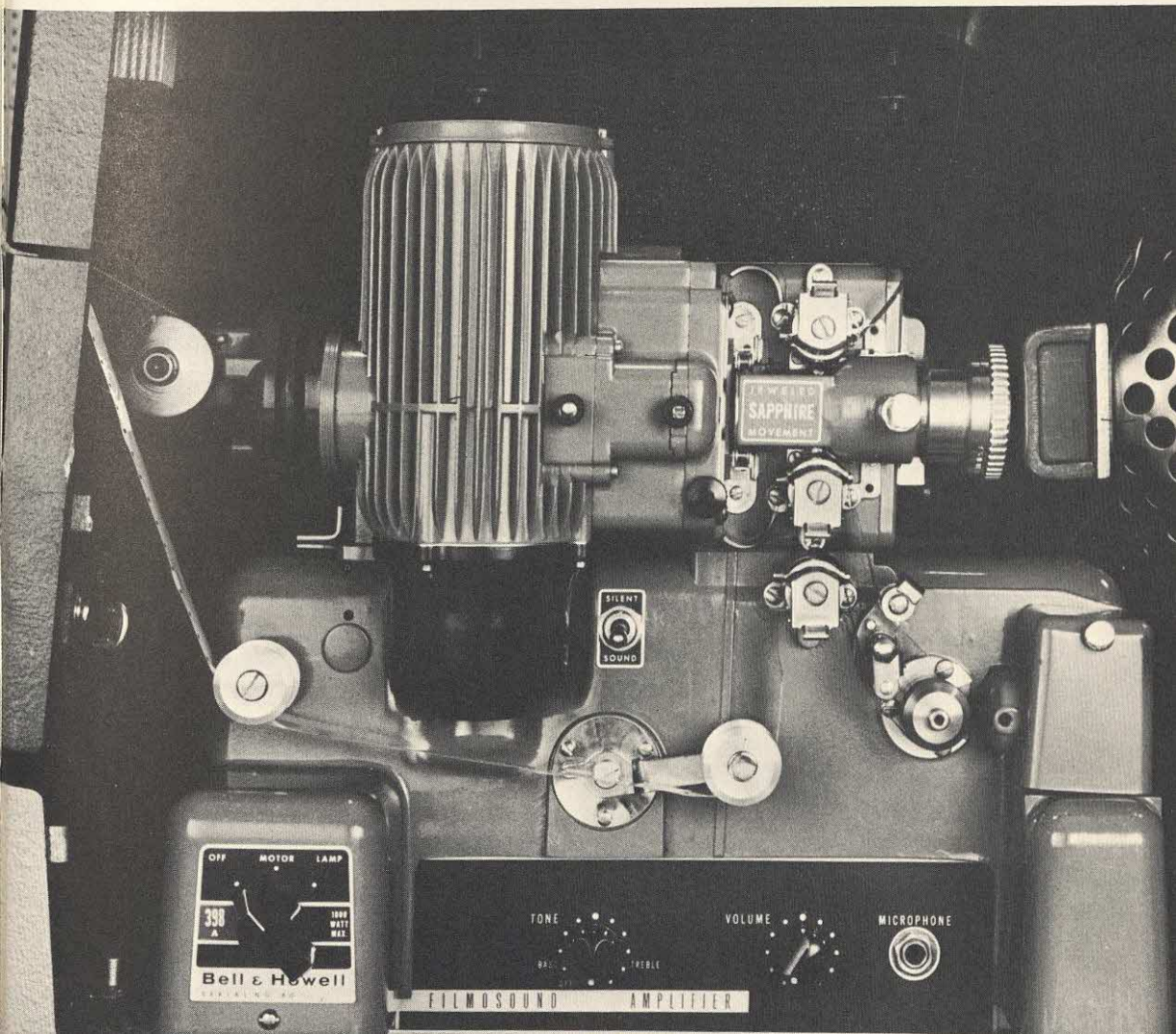
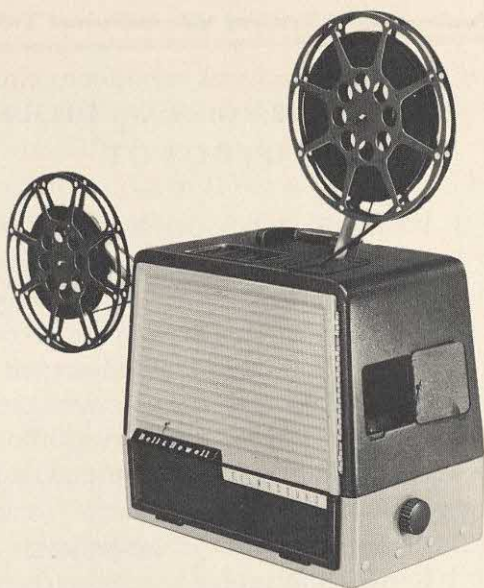
The Motion Picture Projector

Some of the motion picture projectors that teachers will find in their schools will be old, and others will be new. Some machines the teacher will have to thread, in the old sense of the word, and in others most of the threading will be done for the teacher by mechanical means. The trend will be toward increasing automation, but it will probably take five years for replacements to be made in significant numbers; hence the emphasis in this section will be upon the more conventional procedures.

The teacher increases his freedom with machines when he learns to operate them himself. He then can be free of the technicians who serve him, but who confine him somewhat within their own schedules. Motion picture projectors of all types are easy to operate, and, therefore, teachers need only to substitute their fear of this projector and all machines by self-confidence. Enough knowledge and skill to operate these projectors can be gained in about twenty minutes of learning time, but practice to gain speed is another matter. One needs to use a process often to gain dexterity, and, of course, widely spaced intervals between use may cause teachers to forget, thus impairing their confidence. The only way to prevent this is to visit occasionally at the school's technological service center and practice on the preview projector there. If he has not already done so, ask the coordinator to post a threading diagram and keep a roll of practice footage available.

Now, however, is the time to learn some of the fundamentals for operating motion picture projectors in the classroom. Comprehension of the suggestions made will increase the effectiveness of the practice sessions on any of the projectors found in the equipment operation laboratories or in the schools where teachers will begin their careers. There are several crucial stages in the process of classroom motion picture projection, and each will be treated separately. As the reader works through the steps in the various processes as described, he should study the illustrations to identify in several models of motion picture projectors some of the control mechanisms and operations common to all projectors. Readers should begin with Figure 7-18. In the first stage the teacher sets up the projector in the classroom and prepares it for threading.

Figure 7-18. These pictures show an older model of a Bell and Howell double-case motion picture projector, together with a close-up view of its control panel. Identify the control mechanisms as they are described in the step-by-step operational processes. In the Bell and Howell projectors the feed reel is at the right, and the film winds up on the take-up reel from around the bottom in a clockwise motion. (Courtesy Bell and Howell Company, Chicago, Ill.)



PREPARING TO THREAD THE PROJECTOR

1. Wheel the projector into the rear of the classroom and point the front of the projector at the screen in such a way that an imaginary line from the front of the projector to the screen would be perpendicular to it. Some screens are in corners; others are at the center of a room or a little to the right or left of the center.
(Note: If rear projection screens are used in your school, the projector will have to be at the front of the room in back of the screen, or at the side, projecting the image to a mirror first and then through the screen.)
2. Remove the cover if the projector is encased when picked up or delivered, and proceed to move the feed and take-up arms into their proper positions, or insert them in their receptacles as required. Then make sure that drive belts are around the pulleys and in their grooves properly.
3. Connect the power cord to the machine and then to a 115V AC outlet or to an extension cord outlet, and turn on the motor switch. Next turn on the lamp switch and then the amplifier switch (but make sure volume has been turned down), to ascertain that motor, lamp, and amplifier are ready for projection. While carrying out other procedures turn off the lamp and motor but leave the amplifier switch on.
4. Now, if the loudspeaker is in a separate case, place it on a table at the front of the room, or, more conveniently, on a table at the side of the projector at the rear of the room. Newer projectors have loudspeaker systems built into the projector case for convenient sound distribution in normal size classrooms. External speaker output jacks are always available on these projectors for connecting to separate loudspeakers located at the front of classrooms and auditoriums, or other large instructional spaces. There is little doubt that front-of-room locations of loudspeakers are ideal, but convenience must also be considered, and for many purposes the rear-of-room method of distributing sound is not detrimental to learning.
5. Connect the loudspeaker cable to the speaker case, wherever it has been placed, and then connect it to the projector sound-output jack. Since the amplifier has been on for a few minutes and is warmed up, turn up the volume control and listen for the speaker "hiss," the characteristic sound a speaker makes when amplifier volume is turned up. If the speaker emits no noise whatever at a high volume setting, check to see if the exciter lamp is on and if the cable connections are tight and inserted properly. Make sure of loudspeaker readiness or start the

showing and supply your own narration for film content, cancel the showing, or decide to assign other activity to the class while another projector is being procured.

6. Select a take-up reel, and check to see that it is not bent. Then push it on to the take-up arm spindle. Make sure it goes on as far as is necessary to be locked in place securely. If the projector has a clutch on the take-up arm, ascertain that it is in position to drive the reel in the take-up direction.
7. Now turn on the motor and lamp switches again and center the projected light field on the screen. Focus on the edges of the light field, and check to see that the field of light is even. If there are streaks in it, serious enough to warrant it, report it to the technician in charge at once for an adjustment; otherwise report it after the showing. After having ascertained that all is in readiness, turn off the lamp, motor, and amplifier switches. The common error made by operators is to thread the film first, and then start the showing without the picture being in focus and properly centered on the screen. Usually, before the needed adjustments can be made the title and even the opening footage and sound will have passed and the students will have been exposed to bungling by the teacher or a student operator. Teachers should therefore take charge of the situation for the benefit of the pupils and prepare properly.
8. Set tone control knob on *medium* to *medium high* for more intelligible sound. Adjust it later during operation.

The second stage in the conventional classroom motion picture projector operation is the threading process. This is important not only because of its bearing on the smoothness of the presentation, but also because this is precisely the point where teachers, through carelessness, may cause irreparable damage to the film footage itself. Of course this footage can be replaced through purchasing channels, but this takes weeks and sometimes months. The really serious result of such action is the inconvenience and disappointment caused other teachers who had counted on and contracted for the use of the same film at later dates. Hence teachers should take all necessary precautions during this stage of projector operation to fulfill their obligations, being extremely considerate of their colleagues in their own and other schools. In the illustrations a number of threading diagrams are shown so that prospective teachers can examine the ways in which they differ. The following general suggestions will facilitate such study, will speed the learning process in the laboratory or classroom, will assist the teacher to prevent film damage, and will raise the level of showmanship in the handling of film viewing activities by pupils. The operations in the second stage follow. Refer to Figures 7-19, 7-20, 7-21, 7-22, and 7-23.

THREADING THE MOTION PICTURE PROJECTOR

1. Ascertain that the film is ready to thread by noting that (a) the head of the film is at the beginning with title of film and/or the title leader is readable by unwinding three or four feet of film, (b) a square spindle hole in the reel is on the side of the reel away from the operator when the loose end of the film is pulled off the top of the reel to the right, and (c) the sprocket holes in the film are on the edge of the film nearest the operator when the film is in threading position.

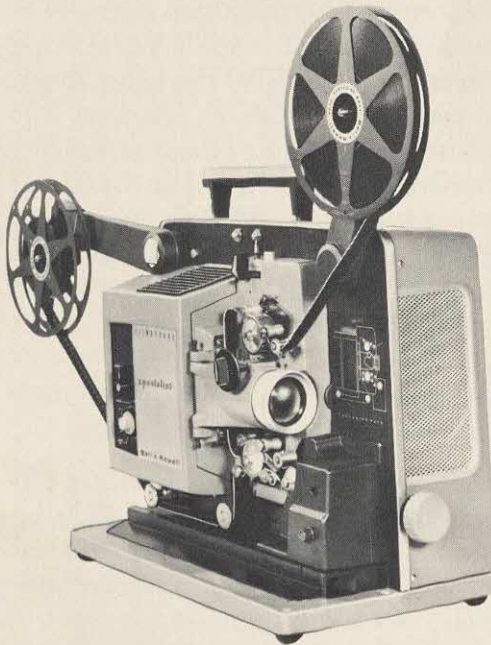
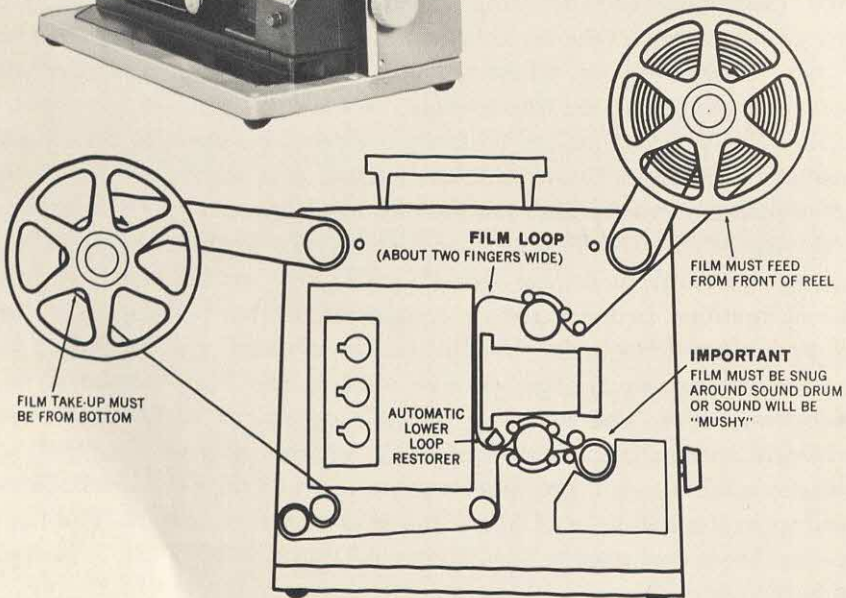
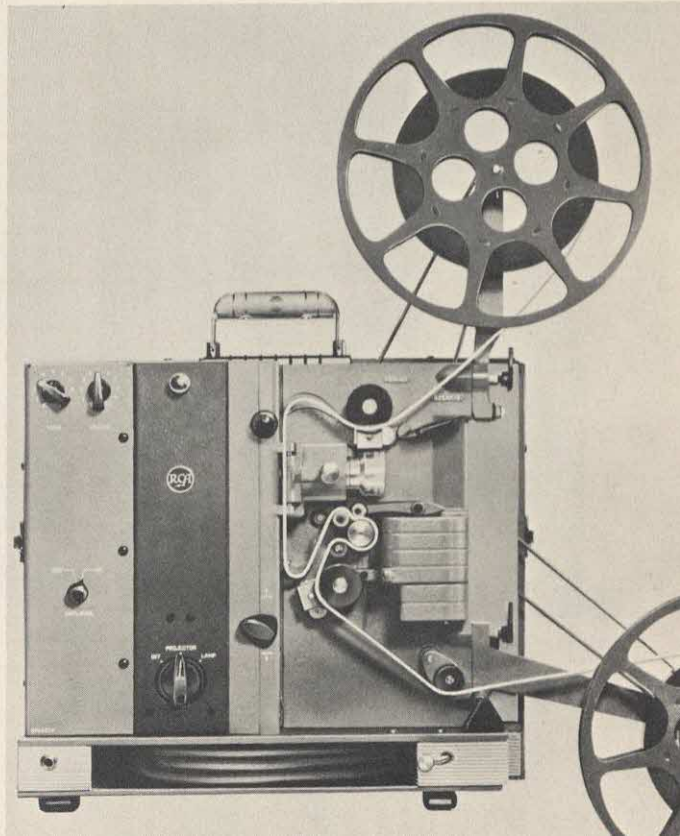


Figure 7-19. Shown in the top picture is the Bell and Howell Model 540 motion picture projector, and shown in conjunction with this projector is the matching diagram for threading it. In connection with each step in the threading process, identify the corresponding operation and mechanism of the projector and the diagram. Repeat this procedure, making a comparison with other diagrams that follow. Also make a comparison with the preceding diagram, Figure 7-18. (Courtesy Bell and Howell Company, Chicago, Ill.)



2. Now push the reel, with the film being pulled off the top of the reel to the right, onto the spindle of the feed arm. Rotate the reel a little to the right or left until the edges of the square hole on the reel fit the edges of the spindle. Make sure the reel is pushed onto the spindle and is securely locked in place.
3. Then draw off about four feet of film from the reel and let it hang down in front of the projector. Open the sprocket shoes in preparation for threading. Now grasp the film near the front of the projector and begin threading, closing the sprocket shoe after making sure that the sprocket teeth are fitted into the perforations in the film. Be critical at this point. Look sharply, and then gently move the film back and forth to feel that it is properly engaged. (Note: Autoloading projectors call for an entirely different procedure. See the illustration. Note also in another of the illustrations how it is more convenient and proper to thread the film from the feed reel into the take-up reel slot before beginning to thread the film sprockets. But note that the film is still unwound from the feed reel to get a length of loose film convenient to work with.)
4. Proceed now to insert or lay the film in the channel behind the lens. Press the film gently just above and below the film gate simultaneously to ascertain that it is deeply seated in the groove.
5. Close the lens, but make sure that when the film gate closes the pressure plate fits perfectly into the groove on top of the film. This is

Figure 7-20. This picture of the RCA motion picture projector incorporates a threading diagram. Tone and volume controls are at the extreme top left, and below on the same panel is the amplifier switch. To the bottom right of this amplifier switch is the motor and lamp switch. Note that the feed reel is at the top. (Courtesy Radio Corporation of America, Camden, N.J.)



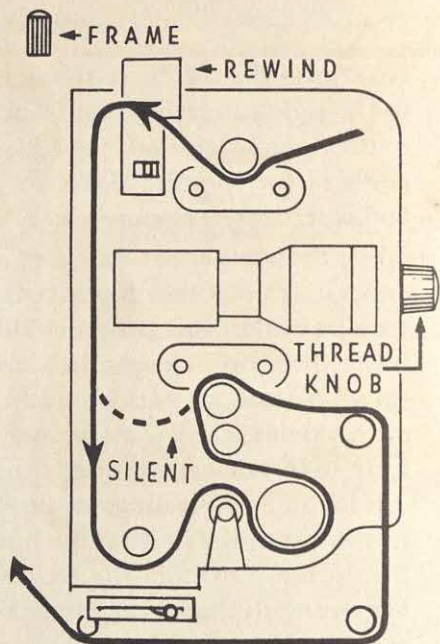


Figure 7-21. This group of pictures shows the Eastman Kodak Pageant motion picture projector and a threading diagram at the top, followed by close-up views of the control panels, the sprocket, and lens area with film and reels ready for rewinding. Notice that the loudspeaker is separate from the projector. Identify on the control panels the direction, motor, and lamp lever switch. Note also microphone and phono inputs for possible use of the projector as a public address system or for use with special silent film footage. Observe in the last close-up picture that a metal lever has been lowered across the film channel just above the back of the lens. This is a rewind mechanism. Note in the top picture that this rewind mechanism is out of the way during forward operation. (Courtesy Eastman Kodak Company, Rochester, N.Y.)

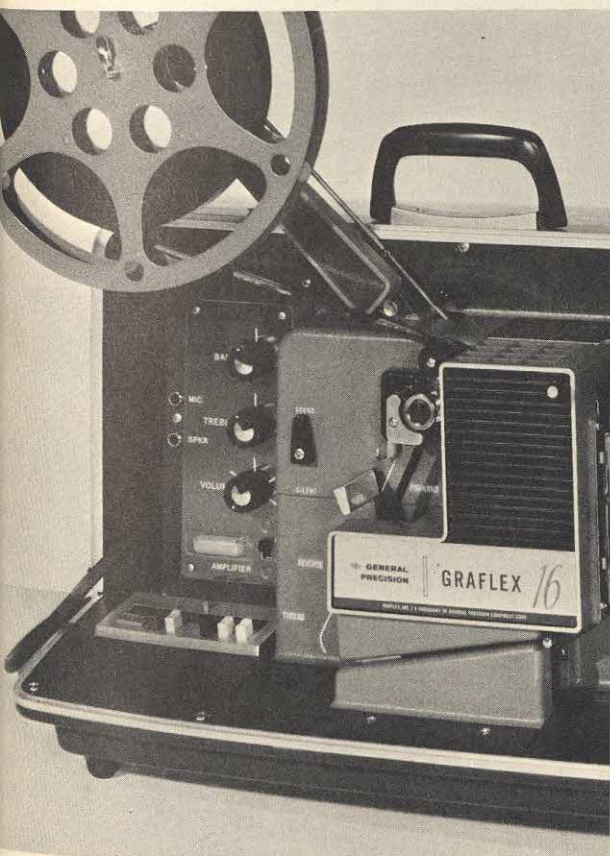
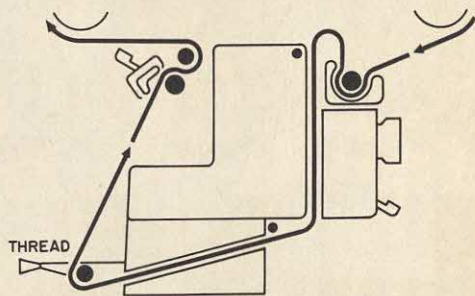
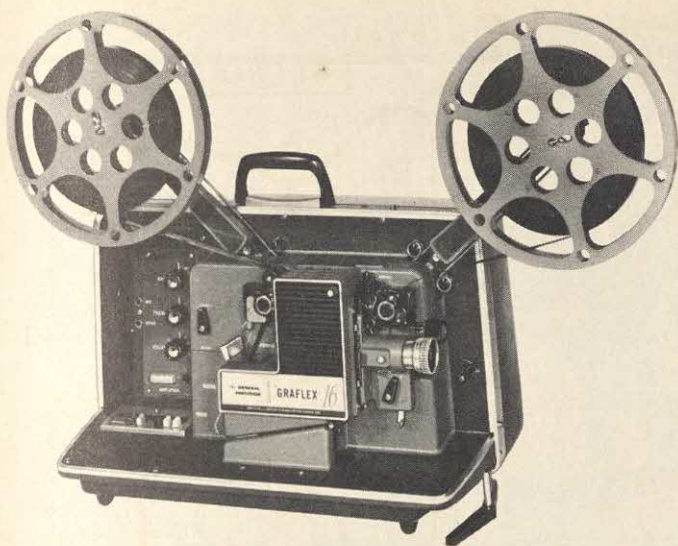


Figure 7-22. These four views show the Graflex 16 projector. Identify in the bottom and right close-up pictures the control mechanisms that have to be used in the operational process of threading and running off a film. Follow the threading process in the diagram, comparing this with the projector itself. Notice the small control panel for the motor and lamp and that the lamp operates at two positions, *normal* and *high*. Is the feed reel at the right? Notice the *forward* and *reverse* lever just below the sprocket in the bottom close-up view. (Courtesy Graflex, Inc., Rochester, N.Y.)

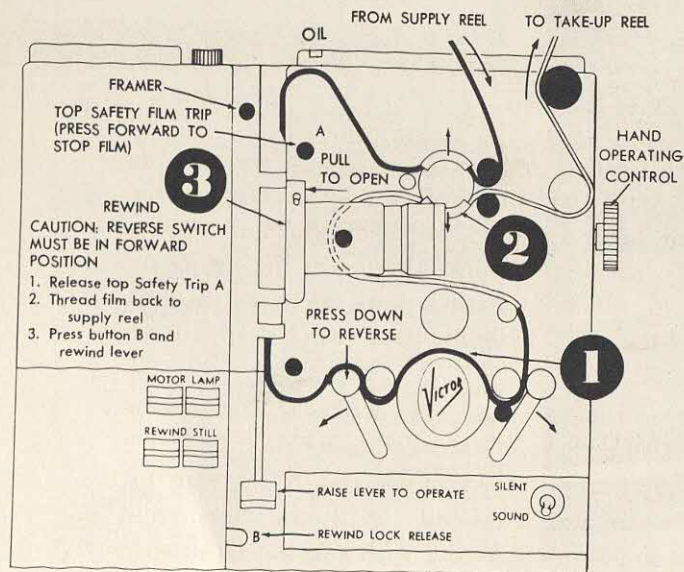
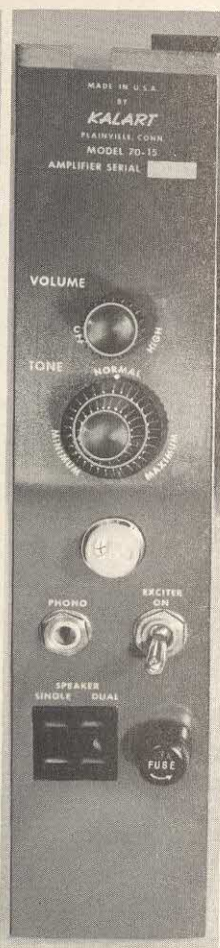
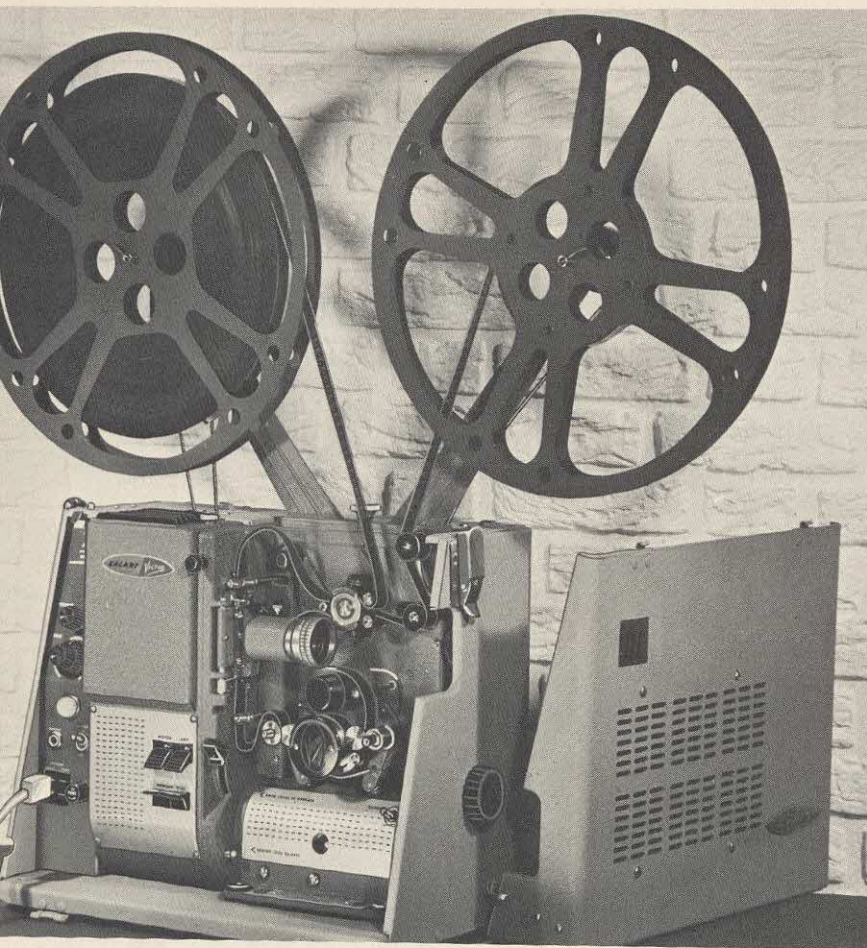


Figure 7-23. This group of pictures shows the Kalart Victor projector. Identify the main control mechanisms and operational features by careful study of projector, control panel, and operational diagram. Feed reel is at left. Take-up reel is at right. Film winds up on the take-up reel in a clockwise manner from the left side of the reel. Note that this projector features a safety trip mechanism that stops the projector if film breaks or serious defects are encountered. (Courtesy Victor Animatograph Corporation, Division of KALART, Plainville, Conn.)

another crucial check point that is essential in preventing film damage. A visual test must be made here as fingers will not be able to reach in and feel this plate.

6. Now complete threading around remaining sprockets and sound drum, forming loops as recommended in the threading diagrams. The film must fit tightly around the sound drum, and this is another crucial check point as loose film here will result in garbled sound.
7. Now insert the tip of the film past the rim of the take-up reel with one hand and grasp the inserted tip with the other, pushing it then into the slot in the reel hub. Next rotate the reel two or three turns until the slack is taken up and the end of the film in the slot cannot pull out.
8. If the projector is so equipped, turn the knob that advances the film in the projector mechanism by hand. This manual test of the threading should always be carried out as an essential safeguard against film damage. If the film loops remain correct, if the take-up reel takes up the film, and the film remains tight around the sound drum, the projector is ready to be started. Note: If a manual control is lacking teachers should start the projector for a few seconds to check loops and sound drums. If time permits, the focus can be checked, after which the projector can be reversed to the desired frame.)

We are now ready at the appropriate time to start the projector and test it during operation. This is Stage Three and the procedures to carry out during this stage follow. As we begin our procedures in this stage let us assume that the previously described readiness procedures have been carried out by the teacher. In studying the steps in this process the reader should refer to Figures 7-18 through 7-24.

RUNNING OFF THE FILM

1. When projector can be threaded and prepared before the viewing group arrives, teachers should start the projector by turning on the lamp and motor switches, after a proper amplifier warm-up period, focus the picture sharply, check the sound, then stop the projector, and reverse the film to the desired starting point, perhaps the first pictorial frame instead of the title. Then the projector is ready for action at the flick of a switch.
2. When the projector has no reverse switch, the action in Item 1 preceding is not easy to carry out, therefore proceed as follows: (a) Turn on the lamp and motor, after amplifier warm up, and (b) be ready for immediate action with right and left hands. With the right hand adjust the focus finely, and, simultaneously, with the left hand turn



Figure 7-24. This Bell and Howell Model 552 Autoload projector may be manually threaded and unthreaded in cases where teachers wish to use a portion of a film in the middle of the reel, or wish to stop after showing a selected portion starting at the beginning. The Autoload projector requires a little more mechanical skill for manual threading than the non-automatic models because of additional film control mechanisms. However, the unthreading process is a simple one when the following steps are taken: (1) Remove the threading mechanism cover, (2) remove the exciter lamp housing, (3) disengage the film from under the guide roller nearest the feed reel, (4) open the three sprocket shoes, (5) disengage film from the take-up snubber rollers near bottom of projector and grasp film with thumb and forefinger of either left or right hand near the lower sprocket to guide it along as it is freed from the mechanism, (6) turn motor switch to reverse position and guide the film as called for in the last step as the reverse action of the mechanism frees it from the sprockets. The illustrated instruction booklets accompanying the projector will provide the necessary details. In normal operation of the projector where a film is to start at the beginning, the projectionist slips the film into a slot just above the lens as shown and in six seconds it glides out at the bottom ready to thread onto the take-up reel. Manual threading is similar to that shown in Figure 7-19. (Courtesy Bell and Howell Company, Chicago, Ill.)

- up the sound. Make adjustments in tone and volume as soon as the presentation is underway.
3. As the showing progresses, pinch the film very lightly between the thumb and forefinger at a point between the projector and the point where the film goes onto the take-up reel to feel if the sprocket holes are being damaged by the sprockets and/or claws. As the film slides

between the thumb and finger an extreme roughness will be felt if the perforations are being torn or enlarged. This is an essential examination for the teacher to make intermittently as it allows the discovery of damage in time to prevent an entire film from being ruined.

4. As the film nears its end, be ready to turn the lamp switch off before the end title leaves the screen; the volume switch is then also turned down to prevent noise from emanating from the loudspeaker. The motor switch may then be turned off or the film may be allowed to run through onto the take-up reel depending on the plans of the teacher. A teacher may call for dim lights to be put on, and then may wish to start discussion or other activity at once, planning to run the balance of the film footage onto the take-up reel, or to disengage it and rewind it, a little later.
5. When the projected image is out of frame on the screen, that is, when a narrow strip of an adjoining frame is noticeable, turn the framing screw one way or the other until the strip disappears.
6. If the projector is so equipped, the film may be stopped to examine the contents of any single frame of the film. In this case a special fire screen drops down to prevent that particular frame from burning up because of the cessation of film motion past very hot light beams. The resulting still picture will of course not be as bright. Be ready to refocus the picture, and then to refocus again as soon as forward motion is resumed. When some projectors are stopped the shutter may stop in such a way that the picture does not show, and in these cases the manual test knob will have to be turned so as to let the light through to the screen.
7. If it is necessary to re-examine a film sequence immediately, and the projector is equipped with that feature, the film projector may be stopped and reversed to the desired spot, then stopped, restarted, and rerun.
8. When the film breaks, stop the projector as soon as possible and re-thread the projector. Run off an extra three-foot section of film. Now pick up the broken end from the take-up reel and slip the portion coming from the projector under it for about a foot, and then hold the sections together and rotate the reel three or four turns to bind the loose ends together firmly by the film footage that covers them. Run off a little more film if it is needed. Make sure that the film will not slip out of the take-up reel when the projector is restarted. Now continue the showing. If possible mark the spot where the break occurred with a strip of paper. This method of taking care of a film break is known as the "tuck-in" method. (Note: Teachers may use a piece of masking tape if handy to connect the film ends, but they

- should never use the type of tape that is clear or colorless, since it may be missed by film inspectors. Pins and clips of all kinds are taboo.)
9. When the film loop is lost, that is, when pictures slide by in a rapid fluttering action on the screen, the teacher may, if the projector is so equipped, reset the loop by a special loop-setting lever while the projector is running. In other cases the projector must be stopped, the loop readjusted by rethreading, and then the projector started up to resume the showing.
 10. As soon as you start the projector make sure that the take-up reel is winding up the film properly. Also check the clutch position and belts, and if necessary use your finger to put extra pressure on the action of the take-up reel. Report faulty operation at once to the service center.

The last stage of the classroom operation of a motion picture projector is the rewinding and packing procedures. Each school or school system will probably have an established policy about this phase of operation. Teachers may in some cases have permission to leave the projector just as it was at the end of the showing, knowing that the equipment will be picked up by the service center crew. In other cases the teachers may be asked to cooperate by rewinding the film, packing up the projector in its case, and returning it in person or by messenger to the school center within agreed time limits. We shall turn to these matters by giving a few suggestions about procedure. Refer particularly to Figures 7-19, 7-21, and 7-23.

THE REWINDING AND PACKING STAGE

1. The main job to be done in rewinding is simply to wind the film from the take-up reel back on the feed reel just the way it came off during projection. To be sure, it is easy, yet mistakes are made when confusion arises, when belts are to be twisted, shifted, or removed from pulleys, and when film reels are to be shifted from rear to front spindles, depending on which projector is being used. Therefore, find out what the specific process is for your projector, or do not rewind the film at all. Fortunately, newer projector models use easier and more foolproof procedures.
2. Ascertain what the policy is at your school. Some service systems and film libraries do not want teachers to rewind films, so follow instructions to minimize inconvenience for others.
3. Take precautions to prevent injury to hands and fingers during the rewinding process. If it is desirable to slow down the speed of moving reels, press the palm of your hand against the side of the reel near the rim and exert a little pressure. Keep fingers pointing outward and

away from the spokes of the reel. Put pressure only on the reel from which the film is being drawn. Let the reel that is winding up the film run under full power so that the film will wind up snugly.

4. Fasten the end of the rewound film down with a small piece of masking tape with its end doubled over to make a tab.
5. Now get help from a student to wind up the cords. If handy, clean off dirt from cords with a paper towel or even a piece of waste paper. Put cords in their proper places in the case.
6. Remove or fold up the reel arms, if asked to do so, lock the projector-case cover in place, and prepare to return the projector or have it picked up, as called for by established procedure.

In the next decade a major breakthrough in the effective implementation of audiovisual technology in education may well happen. Such a breakthrough, as perhaps massive and unprecedented financial support for both facilities and media, will undoubtedly be accompanied by a surge of comprehensive activity far greater in scope than the fairly recent nationwide language laboratory and instructional television movements. Teachers need to be ready for such eventualities for the trends are well marked—ready not only to operate the instruments and to push the technological buttons as advocated in this closing chapter, but also ready to make highly professional decisions, to think creatively, and to innovate, in arranging optimum learning conditions. Such decisions need to involve every known resource for effective classroom action because it will be there that this and succeeding generations will begin the process of identifying and solving the problems that they are certain to face tomorrow. We can predict that in the hands of such skillful teachers the instructional media we have discussed in this book, together with those that will be developed in the future, will play a vital role in the fulfilment of this crucial educational destiny.

Problem-Solving Activities

1. Work through the instrument operation laboratory according to the instructional system established at your school. As time permits, practice the various operations described, but be sure to keep your future classrooms in mind. Always remember that your own class of future pupils is waiting and ready for you to start your presentation. Classrooms are vastly different from your laboratory stations. You must learn to transfer your skill to the larger environment, making the necessary adjustments in placement and operation of the instrument.
2. What responsibility about the use of instructional technology should teachers be willing to accept?

3. What kinds of action are possible if, when you are operating a filmstrip, slide, or a motion picture projector, the picture is too large for the projection screen? Confine your answer to these aspects: (a) projector to screen distance, and (b) focal length of objective lens.
4. How do you make sure ahead of time that a slide or filmstrip is properly inserted into a regular-type projector? How are slides or transparencies placed on the projection stage of an overhead projector with respect to the operator?
5. Next time you observe an opaque projector being used, ascertain if the projector itself and the operator are blocking the view of the screen. What corrective action if any would you suggest?
6. How could you use a mike, fastened to the end of a pole (assume the microphone has an extension cord) to get a high quality tape recording of a class discussion? What most likely happens to the quality of recording when the mike is far away and the volume has to be turned up unusually high?
7. What special connectors would you need to copy a portion of a recording onto tape? What special equipment is needed to use two sources of sound, as, for example, one microphone for voice and a disk or tape-recorded sound effect or music.
8. Write out in basic steps the procedure for making a tape copy from a master tape. Use correct terminology.
9. Just how can bent reels damage a motion picture film? Explain also how the frequent use of the thumb and forefinger, or "pinch" test, will prevent extensive damage.
10. Teachers need to be alert during the running off of a film, being ready to reset the loop if lost, or to stop the projector if the film breaks. What action will you be ready to take so that you can restart a projector after a film breaks with minimum loss of time. (Never run a film onto the floor or into a wastebasket.)
11. Assume that you desire to project a *sound* filmstrip. Where do you place the filmstrip projector, the record player, and the loudspeaker, if separate from the record player?

Available Technological Materials for Class Use

- Duplicating by the Spirit Method*. 16mm motion picture. Bailey Films. Color. 15 min. (Use to supplement text information, and to introduce this easy method for producing multi-colored ditto sheets of instructional materials.)
- Facts About Film* (2nd ed.). 16mm motion picture. International Film Bureau. Color. 12 min. (Use to present basic information about film and its care and handling.)
- Facts About Projection* (2nd ed.). 16mm motion picture. International Film Bureau. Color. 16 min. (Use as an introduction to laboratory operation, and to present basic information about the way a motion picture projector operates.)

- Operation and Care of the Ampro Super Stylist*. 16mm motion picture. International Film Bureau. B & W. 21 min. (Use if students are to learn to operate this projector in the laboratory. Presents basic information.)
- Operation and Care of the Bell and Howell Projector* (2nd version). 16mm motion picture. International Film Bureau. B & W. 11 min. (Use as an introduction to actual operation in the laboratory. Series 385 projector.)
- Operation and Care of the Bell and Howell Projector* (3rd ed.). 16mm motion picture. International Film Bureau. B & W. 11 min. (Same as 2nd version except projector shown is Series 540 and 542. Use as introduction.)
- Operation and Care of the RCA 400 Projector*. 16mm motion picture. International Film Bureau. B & W. 18 min. (Use as an introduction.)
- Operation and Care of the Victor Sound Projector*. 16mm motion picture. International Film Bureau. B & W. 11 min. (Use as introduction to actual operation in the laboratory.)
- Tape Recording for Instruction*. 16mm motion picture. Indiana University. B & W. 15 min. (Use to emphasize operational procedures.)

Some Additional References

- Audio-Visual Equipment Directory* (Annual Edition). Fairfax, Virginia: National Audio-Visual Association, 1965 and annually.
- Brown, James W., Richard B. Lewis, and Fred F. Harclerod. *A-V Instruction, Materials and Methods* (2nd ed.). New York: McGraw-Hill, 1964.
- Eboch, Sidney C. *Operating Audio-Visual Equipment*. San Francisco: Chandler, 1960.
- Finn, James D. *The Audio-Visual Equipment Manual*. New York: Holt, 1957.
- Mannino, Philip. *ABC's of Audio-Visual Equipment*. Rev. ed. University Park, Pa.: M. O. Publishers, 1959.

APPENDIX:
PARTIAL LISTING:
SOURCES OF
MATERIALS,
INSTRUMENTS,
AND SUPPLIES

This directory is designed to be useful for both the instructor and the student in courses in methods of teaching in college. The emphasis is upon materials and the supplies likely to be needed in preparing materials rather than upon equipment. Because the equipment directory listed, if available in libraries or other resource centers, will permit detailed study of specifications of all commonly known audiovisual classroom instruments, hundreds of instrument manufacturers will be omitted from this list of sources. The same applies to producers of programmed learning sequences and other teaching machines who are listed in the two guides described under general listings of sources. The producers of materials and supplies listed in the following pages constitute only a fraction of the total number. With students in mind, generally, only the most comprehensive producers were included.

Some General Listings of Sources

Audio-Visual Equipment Directory (Annual Edition). Published by the National Audio-Visual Association, Fairfax, Virginia. (Price for each edition, \$5.00.)

Directory of 3660 16mm Film Libraries. By Seerley Reid, Anita Carpenter, and Annie Dougherty, published by U.S. Department of Health, Education and Welfare, Office of Education. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Educational Television Motion Pictures, Descriptive Catalog. National Education Television Film Service, Audio-Visual Center, Indiana University, Bloomington, Ind.

A Guide to Programed Instructional Materials Available to Educators By September 1963. Compiled and produced by the Center for Programed Instruction, Inc., in cooperation with the U.S. Department of Health, Education and Welfare, Office of Education. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. (Price \$1.50.)

Guides to Newer Media. By Margaret I. Rufsvold and Carolyn Guss for the American Library Association in cooperation with the U.S. Department of Health, Education and Welfare, Office of Education. For sale by the American Library Association, 50 East Huron, Chicago 11, Ill.

National Tape Recording Catalog. Published by the Department of Audio-visual Instruction of the NEA, Washington, D.C., 1962 Edition. (Price, \$2.00.) Copies of the tapes listed are obtainable at nominal charges from the National Tape Depository, Audio-Visual Center, University of Colorado, Boulder, Colo.

New Media Index, (First Comprehensive Source Book). Published by McGraw-Hill Book Company, Inc., New York, in cooperation with U.S. Department of Health, Education and Welfare, Office of Education, 1964.

Sources of Information on Educational Media. By John A. Moldstad for the Educational Media Council in cooperation with the U.S. Department of Health, Education and Welfare, Office of Education. For sale by the Superin-

tendent of Documents, U.S. Government Printing Office, Washington, D.C. *Teaching Machines and Programed Learning, A Survey of the Industry*, 1962.

By James D. Finn and Donald G. Perrin, for the Technological Development Project, under the U.S. Department of Health, Education and Welfare, Office of Education. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. (Price 55¢.)

U.S. Government Films for Public Educational Use (1963). By Seerley Reid, Katherine W. Clugston, and Eloyse Grubbs for the U.S. Department of Health, Education and Welfare, Office of Education. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. (Price \$3.)

Some Source Listings for Free and Inexpensive Materials

Catalog of Free Teaching Aids by Gordon Salisbury and Robert Sheridan. P. O. Box 943, Riverside, California.

Educator's Guide to Free Films by Mary F. Horkheimer and John W. Diffor. *Educator's Guide to Free Slide Films* by Mary F. Horkheimer and John W. Diffor. *Educator's Guide to Free Tapes, Scripts, and Transcriptions*, by Walter A. Wittich and Gertie H. Halsted. *Elementary Teacher's Guide to Free Curriculum Materials*. All are revised periodically. Published by Educators Progress Service, Randolph, Wisconsin.

Free and Inexpensive Learning Materials, prepared by the Division of Surveys and Field Services, George Peabody College for Teachers, Nashville, Tenn.

Sources of Free and Inexpensive Education Materials. Field Enterprises, Inc., Merchandise Mart Plaza, Chicago 54, Ill.

Sources of Free and Inexpensive Teaching Aids, by Bruce Miller. P. O. Box 369, Riverside, Calif.

The National Professional Organization and its Journals

The Department of Audiovisual Instruction of the NEA. Dr. Anna L. Hyer, Executive Secretary. Headquarters at 1201 Sixteenth Street, N.W., Washington, D.C. Memberships \$7.00 and \$12.00 including the first or both journals. Institutional memberships are \$25.

JOURNALS

Audiovisual Instruction. Ten issues annually. Send subscriptions to DAVI of the NEA, 1201 Sixteenth Street, N.W., Washington, D.C. Non-member rate, \$6.

Audio Visual Communication Review. Six issues annually with supplements. Send subscription to the Department. Non-member rate, \$6.

Two other organizations of specialized nature are the following: (1) *The National Association of Educational Broadcasters*, 14 Gregory Hall, University of Illinois, Urbana, Ill. (2) *The Educational Film Library Association*, 250 West 57th Street, New York 19, N.Y.

Additional Magazines Devoted to the Field

Educational Screen and Adiovisual Guide. Business and Editorial Office, 415 North Dearborn, Chicago 10, Ill. Subscription rate, \$4 for ten issues.

Film News. Published by the Film News Co., 444 Central Park West, New York 25, N.Y. Subscription rate is \$3 for six issues.

Film World and A-V News Magazine. Published monthly. Publication office: Sidale Publishing Co., 672 South Lafayette Park Place, Los Angeles 57, Calif. Subscription rate is \$4.

NAEB Journal. Published eight times a year by the National Association of Educational Broadcasters, 14 Gregory Hall, University of Illinois, Urbana, Ill. Subscription rate is \$4.

A Few of the Major Producers of Audiovisual Materials

MOTION PICTURES

Bailey Films, 6509 DeLongpre Avenue, Hollywood, Calif.

Churchill Films, 807 N. Seward, Los Angeles 38, Calif.

Coronet Instructional Films, Coronet Building, Chicago, Ill.

The Ealing Corporation, Cambridge, Mass.

Encyclopaedia Britannica Films,

1150 Wilmette Avenue, Wilmette, Ill.

Film Associates of California, 11014 Santa Monica Boulevard, Los Angeles 25, Calif.

Frith Films, 1816 N. Highland Avenue, Hollywood, Calif.

Indiana University, Audio-Visual Center, Bloomington, Ind.

International Film Bureau, Inc., 332 South Michigan Avenue, Chicago 4, Ill.

McGraw-Hill Textfilm Division, 330 West 42nd Street, New York 36, N.Y.

Moody Institute of Science, 11428 Santa Monica Boulevard, Los Angeles 25, Calif.

United World Films, Inc., 1445 Park Avenue, New York 29, N.Y.

University of Southern California, Film Distribution Unit, Department of Cinema, University Park, Los Angeles 7, Calif.

FILMSTRIPS

Herbert E. Budek Company, Inc., 324 Union Street, Hackensack, N.J.

Bailey Films, Inc., 6509 DeLongpre Avenue, Hollywood, Calif.

Encyclopaedia Britannica Films, 1150 Wilmette Avenue, Wilmette, Ill.

Eye Gate House, 146-01 Archer Avenue, Jamaica 35, N.Y.

Filmstrip House, 347 Madison Avenue, New York, N.Y.

The Jam Handy Organization, 2821 East Grand Boulevard, Detroit 11, Mich.

Informative Classroom Picture Publishers, 31 Ottawa Avenue, N.W., Grand Rapids 2, Mich.

Life Magazine Filmstrips, Time and Life Building, Avenue of the Americas, New York, N.Y.

McGraw-Hill Textfilms, 330 West 42nd Street, New York 36, N.Y.

Row, Peterson and Company, 1911 Ridge Avenue, Evanston, Ill.

Society for Visual Education, 1345 Diversey Parkway, Chicago 14, Ill.

Stanley Bowmar Company, Inc., 12 Cleveland Street, Valhalla, N.Y.

SLIDES

American Library Color Slide Company, Inc., 222 West 23rd Street, New York 1, N.Y.

American Museum of Natural History, Central Park West at 79th Street, New York 24, N.Y.

Art Color Slides, Inc., 235 East 50th Street, New York 22, N.Y.

Clay-Adams Company, Inc., 141 East 25th Street, New York 10, N.Y.

Geographical Slide Service, 200 East Irvin Avenue, State College, Pa.

Kelly F. Choda, Box 15, Palmer Lake, Colo.

Keystone View Company, Meadville, Pa.

Metropolitan Museum of Art, Fifth Avenue and 82nd Street, New York 38, N.Y.

Dr. Konrad Prothman, 2378 Soper Avenue, Baldwin, Long Island, N.Y.

Society for Visual Education, 1345 Diversey Parkway, Chicago 14, Ill.

Ward's Natural Science Establishment, Inc., 3000 East Ridge Road, Rochester 9, N.Y.

MODELS AND OBJECTS, MAPS AND GLOBES, CHARTS

Aero Service Corp., 210 East Courtland Street, Philadelphia, Pa.

Carolina Biological Supply Co., Burlington, N.C.

Central Scientific Company, 1700 Irving Park Boulevard, Chicago, Ill.

Clay-Adams Company, Inc., 141 East 25th Street, New York 10, N.Y.

Creative Playthings, Inc., Princeton, N.J.

Denoyer-Geppert Company, 5235 Ravenswood Avenue, Chicago, Ill.

Edmund Scientific Co., 101 East Gloucester Pike, Barrington, N.J.

Farquhar Transparent Globes, 3724 Irving Street, Philadelphia 4, Pa.

General Biological Supply House, Inc., 8200 South Hope Avenue, Chicago, Ill.

Geo-Physical Maps, Inc., School Division, 101 Park Avenue, New York 17, N.Y.

C. S. Hammond and Company, 809 North 19th Street, Philadelphia, Pa.

T. N. Hubbard Scientific Co., Box 105, Northbrook, Ill.

International Communications Foundation, 870 Monterey Pass Road, Monterey Park, Calif.

The Judy Company, 310 North 2nd Street, Minneapolis 1, Minn.

The Learning Center, Inc., 53 Bank Street, Princeton, N.J.

Milton Bradley Company, 74 Park Avenue, Springfield 2, Mass.

Models of Industry, 2100 Fifth Avenue, Beverley, Calif.

Modern School Supply Co., Inc., Goshen, Ind.

Rand McNally and Company, 8255 Central Park Avenue, Skokie, Ill.

A. J. Nystrom and Company, 3333 Elston Avenue, Chicago 18, Ill.

Revell, Inc., Venice, Calif.

Rudolph Schick Publishing Co., 661 Massachusetts Avenue, Arlington, Mass.

Scott, Foresman and Co., 433 East Erie Street, Chicago, Ill.

Superior Plastic, Inc., 426 N. Oakley Boulevard, Chicago, Ill.

Vis-X Company, 4870 Eagle Rock Boulevard, Los Angeles 41, Calif.

Ward's Natural Science Establishment, Inc., 3000 East Ridge Road, Rochester, N.Y.

W. M. Welch Scientific Company, 1515 Sedgwick Street, Chicago, Ill.

STUDY PRINTS

Artext Prints, Inc., Strawberry Hill Avenue, Norwalk, Conn.
 Audio-Visual Enterprises, 4405 Springdale Drive, Los Angeles 43, Calif.
 British Information Services, 45 Rockefeller Plaza, New York 20, N.Y.
 Colonial Art Company, 1336 First Street, N.W., Oklahoma City, Okla.
 Creative Education Society, Mankato, Minn. (Bound volumes of pictures.)
 Documentary Photo Aids, Box 2237, Phoenix, Ariz.
 Encyclopaedia Britannica Films, 1150 Wilmette Avenue, Wilmette, Ill.
 Friendship Press, 475 Riverside Drive, New York, N.Y.
 John Gunter Curriculum Materials, 1027 South Claremont Street, San Mateo, Calif.
 Hi-Worth Pictures, P. O. 6, Altadena, Calif.
 Informative Classroom Picture Publishers, 31 Ottawa Avenue, N.W., Grand Rapids 2, Mich.
 International Communications Foundation, 870 Monterey Pass Rd., Monterey Park, Calif.
 Marguerite Brown Study Prints, Compton, Calif.
 National Audubon Society, 1130 Fifth Avenue, New York, N.Y.
 National Geographic Society, School Service Division, 16th and M Streets, N.W., Washington, D.C.
 A. J. Nystrom and Company, 3333 Elston Avenue, Chicago 18, Ill.
 F. A. Owen Publishing Co., Dansville, N.Y.
 Perry Pictures, 42 Dartmouth Street, Malden, Mass.
 Realistic Visual Aids, Highland, Calif.
 Society for Visual Education, 1345 Diversey Parkway, Chicago, Ill.
 Teaching Film Custodians, Inc., 25 W. 43rd Street, New York, N.Y.
 United Nations, Department of Public Information, New York, N.Y.

PRERECORDED TAPES

EMC Recording Corporation, 806 East 7th Street, St. Paul 6, Minn.
 Language Training Aids, 12101 Valleywood Drive, Silver Spring, Md.
 National Tape Depository, Audio-Visual Center, University of Colorado, Boulder, Colo.
 National Tape Library, 930 F Street, N.W., Washington, D.C. (Write also to State University Audiovisual Centers.)

DISK RECORDINGS

American Book Company, 55 Fifth Avenue, New York, N.Y.
 Audio Education, Inc., 55 Fifth Avenue, New York 3, N.Y.
 Capitol Records, Education Department Capitol Tower, 1750 Vine Street, Hollywood, Calif.
 Gloria Chandler Recordings, 277 West 12th Street, New York 14, N.Y.
 Children's Music Center, 2858 West Pico Boulevard, Los Angeles 6, Calif.
 Children's Reading Service, 1078 Saint John's Place, Brooklyn 13, N.Y.

- Children's Record Guild, 27 Thompson Street, New York 13, N.Y.
 Columbia Records, Educational Division, 799 Seventh Avenue, New York 19, N.Y.
 Educational Recording Services, 5922 Abernathy Drive, Los Angeles, Calif.
 Educational Services, 1730 Eye Street, N.W., Washington, D.C.
 Enrichment Teaching Materials, Inc., 246 Fifth Avenue, New York 1, N.Y.
 Folkways Records, 121 West 47th Street, New York, N.Y.
 Harcourt, Brace and World Company, Inc., 750 Third Avenue, New York, N.Y.
 Linguaphone Institute, 30 Rockefeller Plaza, New York 20, N.Y.
 Listen and Learn with Phonics, N-6, 3746 Park Boulevard, Oakland, Calif.
 National Council of Teachers of English, 704 South Sixth Street, Champaign, Ill.
 RCA Victor Division, Educational Services, Radio Corporation of America, Camden, N.J.
 Scott Foresman and Company, 19-00 Pollitt Drive, Fair Lawn, N.J.
 Silver Burdett Company, Morristown, N.J.
 Storytoons, Inc., 23 North Avenue East, Crawford, N.J.
 Thomas J. Valentino, 150 West 46th Street, New York, N.Y.

LARGE TRANSPARENCIES

- Aero Service Corp., 210 East Courtland Street, Philadelphia, Pa.
 Encyclopaedia Britannica Films, Over-view Transparency Division, 1150 Wilmette Avenue, Wilmette, Ill.
 Instructo Products Co., 1637 North 55th Street, Philadelphia, Pa.
 John Colburn Associates, Inc., 1122 Central Avenue, Wilmette, Ill.
 Keuffel and Esser Co., Audiovisual Division, Hoboken, N.J.
 Modern School Supply Co., Inc., Goshen, Ind.
 Ozalid Division, General Aniline and Film Corporation, Johnson City, N.Y.
 RCA Educational Services, RCA Service Company, Building 206-1, Cherry Hill Offices, Camden 8, N.J.
 Science Research Associates, Inc., 259 East Erie Street, Chicago, Ill.
 Teachers Publishing Corporation, Darien, Conn.
 Tecnifax Corporation, 195 Appleton Street, Holyoke, Mass.
 Tweedy Transparencies, 321 Central Avenue, Newark 3, N.J.
 United Transparencies, Inc., 57 Glenwood Avenue, Binghamton, N.Y.

INSTRUCTIONAL KITS

- Aetna Life Affiliated Companies, Information and Education Department, Farmington Avenue, Hartford, Conn.
 Bell Telephone System (Local Offices).
 Chester Electronic Laboratories, Chester, Conn.
 Encyclopaedia Britannica Films, 1150 Wilmette Avenue, Wilmette, Ill.
 International Communications Foundation, 870 Monterey Pass Road, Monterey Park, Calif.
 The Learning Center, Inc., 53 Bank St., Princeton, N.J.
 Listen and Learn with Phonics, N-6, 3746 Park Boulevard, Oakland, Calif.

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 Keuffel and Esser Company, Audiovisual Division, 520 South Dearborn Street, Chicago, Ill. (Also at Hoboken, N.J.)
 Milton Bradley Company, 74 Park Avenue, Springfield 2, Mass.
 Ozalid Division, General Aniline and Film Corporation, Johnson City, N.Y.
 Tecifax Corporation, 195 Appleton Street, Holyoke, Mass.
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 Arthur Brown and Brothers, Inc., 2 West 46th Street, New York, N.Y.
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 Eastman Kodak Company, 343 State Street, Rochester 4, N.Y. (Cameras and supplies.)
 Exakta Camera Company, 705 Bronx Road, Bronxville 8, N.Y. (Cameras.)

General Electric Company, Apparatus Division, 1 River Road, Schenectady 4, N.Y. (Exposure meters and lamps.)

Nikon, Inc., 251 Fourth Avenue, New York 10, N.Y. (Cameras.)

Polaroid Corporation, Cambridge 39, Mass. (Cameras, copying stand with lights, transparency film.)

Prakticon Company, 705 Bronx Road, Bronxville 8, N.Y. (Cameras.)

Quick-Set, Inc., 8109 North Central Park Avenue, Skokie, Ill. (Tripods.)

MOTION PICTURE CAMERAS

Bell and Howell Company, 7100 McCormick Road, Chicago 45, Ill.

Eastman Kodak Company, 343 State Street, Rochester 4, N.Y.

Fairchild Camera and Instrument Corporation, Industrial Products Division, 221 Fairchild Avenue, Plainview, Long Island, N.Y.

Paillard Products, Inc., 100 Sixth Avenue, New York, N.Y.

Victor Animatograph Corporation, Plainville, Conn.

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